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NOTES ON EUROPEAN MUSEUMS.

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THE accompanying notes were first made with no thought of publication, they having been jotted down for purposes of a report to the Trustees of the Field Columbian Museum and for personal use during a hurried tour taken in the fall of 1898 among some of the principal natural history museums of Europe. Shortly after my return, however, being handed by Dr. Hovey a copy of his "Notes,"[1] I not only considered them to be of much interest and value, but was led to reflect on the scantiness of museum literature in general, and the probable utility of even small contributions to the subject. I have, therefore, arranged my rambling memoranda on a plan quite similar to that adopted by Dr. Hovey, but without repeating his observations where they resembled mine. For a like reason I have not followed the geographical order of my travels, but have given first my notes on museums not mentioned in his article.

[1] Hovey, Edmund Otis. Notes on Some European Museums, *Am. Nat.*, September, 1898.

Vienna. — The magnificent building of the Naturhistorisches Hofmuseum, which has been open to the public since 1889, is probably the most costly structure in the world devoted to purposes of a natural history museum. It is in the form of a hollow rectangle, 554 feet long and 230 feet broad. It is lighted from the side by numerous long windows. Only the outer two-thirds of the building is devoted to exhibition halls. The inner third is used for work and storage rooms, study collections, etc. This arrangement has the advantage of securing the best light for the exhibition halls and of making the work and storage rooms closely adjacent to the corresponding collections. It is also to be noted that the arrangement of the halls is such as to compel a consecutive line of progress from the single entrance and back to it again. A unique and pleasing feature of the interior decorations is the adornment of the walls of many of the halls by paintings which relate to or illustrate the collections. Of the thirty-nine halls, five are devoted to the mineralogical-petrological collections and five to the paleontological. The first hall of the mineralogical series contains what is termed a terminological collection in which the forms, properties, and genesis of minerals are illustrated. The two adjoining halls and part of a third contain the systematic mineral collection arranged according to Groth's system. The second of these halls contains as well the collection of precious stones and a collection of ores. The remainder of the third hall is occupied by a collection of building materials, marbles, etc., while in Hall No. 5 are the systematic rock collection and the world-famous collection of meteorites.

The cases adopted are, for the floors, desk cases of mahogany with pyramidal tops of low slope; for the walls, vertical cases of mahogany about 8 feet high and 2 feet deep, on bases 3 feet high. The floor cases accommodate only small specimens; the large specimens are shown in the wall cases. The case interiors are black. The method of mounting employed is that of black walnut blocks.

One difficult problem in mounting, *viz.*, a proper installation of cave specimens, seems to have been solved in this museum. The stalactites are fastened to individual wooden shelves pro-

jecting from the back of a wall case. The label, being then placed over the front of the shelf and projecting below it, hides any imperfection of the joint.

The collection showing varieties of marble is large and complete, and is the only collection which I saw in Europe having the different varieties fully and accurately labeled. Another commendable feature of the labeling of these and specimens of building stones is the use of a supplementary label (of a yellow color) upon which are mentioned important buildings or works of art in the construction of which the different stones have been used. The only criticism I would make on this collection is that the specimens are too small, being only 3 x 4 inches in size, to adequately represent the varieties. The marbles and building stones form a part of a collection of structural material, all of which is arranged geographically and is divided into the groups of road material, paving material, raw material for bricks, mortar, sand, raw material for cement, building stones, decorative stones, roofing slates, and marbles. Introductory to the systematic rock collection is a so-called terminological collection, made up of the following: rock-forming minerals, rock structures (amorphous, crystalline, conglomerate), varieties of structure of crystalline rocks, varieties of structure of clastic rocks, modifications of stratified rocks, modifications of massive rocks, accessory modifications, inclusions, and rocks of sedimentary, eruptive, and metamorphic origin. The classification adopted for the systematic collection is that of Kalkowsky, as given in his *Elemente der Lithologie*. The specimens are of the uniform size, 3 x 4 x 1 inches, and are labeled as to locality and species. Supplementary to this collection are suites of rocks from different volcanic regions, such as the island of Teneriffe, Bourbon, and Vesuvius. The great meteorite collection, which is not only the greatest of its kind in the world, but is also considered the most costly and valuable of any collection in the museum, is exhibited for the most part in floor cases of the uniform type, but some of the larger specimens are shown in two separate upright cases. The main collection is systematically arranged according to Tschermak's classification. There are also several accessory collections which illus-

trate the history of meteorites, their constituents, forms, and structures. The smaller specimens are mounted on circular, ebonized blocks, the larger ones on individual mounts adapted to each specimen.

In the paleontological division the arrangement of the collections is in order of time, beginning with the earliest and extending to the period of man. The fossil plants are placed in a series by themselves and occupy the first hall. With them are shown such indeterminate forms as Arthrophycus, Cruziana, and Bythotrephis. In the next hall, seeming somewhat out of order, is a dynamical collection arranged on a classification of Professor Heim of Zurich, also large specimens of ripple marks, basalt columns, glacial markings, etc. There are also shown stratigraphic series arranged in vertical order. In the three remaining halls follow, in order, specimens of the faunas of the Paleozoic, Mesozoic, and Cenozoic ages, the last, of course, occupying much the largest relative space. Together with each of these are shown series of the typical rocks, chiefly from Austrian localities, of the strata of each age. The only feature of installation especially noted in the collection of fossils was the method employed for mounting incomplete skeletons. Black plaster forms having the shape of the body cavity and containing properly shaped depressions for each bone are prepared and the bones mounted on them. In this way the general form of the animal is presented to the eye and the bones are easily removable.

The museum is free to the public on Sundays, Thursdays, and holidays. Mondays, Wednesdays, and Saturdays payment is required of 1 krone (about 20 cents). A charge of 20 hellers (about 4 cents) is made for checking umbrellas, canes, etc.

Dresden. — The natural history collections are contained in the building of the rococo-baroque style of architecture which is the home as well of the art gallery so well known to European tourists. It is not to be expected that a building of this type would be well suited to the purposes of a natural history museum, and it is pleasing to note that plans for a new structure, expressly for the purposes of the natural history museum,

are already under way. Yet many of the peculiarities of the present building have been turned to good account in the present installation, and the museum furnishes a good illustration of how much a little ingenuity will do in overcoming limitations of space and light. The geological collections at the time of my visit were largely undergoing a change of installation so that I could not judge what their future appearance was to be. The zoölogical and ethnological collections were, however, quite fully installed. In these there was evidence of much thought and care in the installation, and many original and unique devices were to be seen. The cases are all of metal and glass, this being one of the few museums where this sort of case has been adopted. They are likewise largely uniform in type, being vertical floor cases about 10 feet high and perhaps 6 feet square. These are raised from the floor about 8 inches by legs. Such cases would usually be considered too large and deep for the proper display of small specimens, but by the use of a set of shelves narrowing toward the top, a pyramidal installation is secured, and even small specimens show up surprisingly well. The case interiors are cream white. Where wall cases are desired a case half the thickness, but of the same type, is employed. The top and often the sides of the case are fitted with ground glass. The doors are fastened by a vertical rod on the outside. The sashes of each door are so arranged as to have three long panes along the line of vision, with a row of shorter panes above and below. Thus the immediate field of ordinary vision is made large and glass is economized. The shelves are of glass and are supported on brackets of simple angle irons which are screwed to the wall plates with thumbscrews, or fit into a series of slots. Quite as often the brackets are fastened in front and project backward the width of the shelf, the evident purpose being to bring the contents of the case as near the eye as possible. The rows of slots are covered by thin strips of metal painted the color of the case interior, and thus the unsightly holes which usually accompany adjustable shelves are not to be seen. The metal and glass plan is followed throughout, even the trays used to hold the specimens, and the label holders, being of tin, while

wire is used for any special support. Thus there is nothing in the case or mounts capable of decay or of producing dust. Dust from the floors is further reduced to a minimum by having them covered with linoleum. The use of curtains in the cases is another unique feature. These are of the ordinary window-shade type and are let down in the middle, dividing the case into two parts and giving backgrounds. By the employment of curtains of different colors, pleasing effects are produced. The collection of corals and siliceous sponges, for example, is seen against a black curtain, the collection of jade against a red curtain, and a collection of Chinese pottery against a curtain of Oriental type. The division of the collections seemed to me likewise commendable in that it was well calculated to arouse the interest of the average visitor. Instead of the usual rows of genera and species arranged in synoptic order, the whole effect of which is first to impress the visitor with the fact that he knows nothing of that science, and second to convince him that he does not care to, there are small collections gathered around some common name or common idea from which study is led out to a wider field. Thus one case is devoted to a collection of doves, another to one of men-like apes, another to birds' nests, etc. There are provided in abundance tables, chairs, and books relating to the collections which invite to further study. Where space does not permit tables, a sloping shelf, fastened to one of the pillars or walls of the building, is used for a book support. Framed maps, colored to show the distribution of species, are also hung freely about. The zoölogical-ethnographical museum is open Sundays, Mondays, Thursdays, and holidays from 11 to 1, and Wednesdays and Saturdays from 1 to 3, free. It is closed Tuesdays.

Munich. — The important natural history collections in this city are to be seen in the building of the Academy of Science. This is a plain rectangular building of several stories, lighted by side windows. The mineralogical collection is to be found on the first floor, the paleontological on the second. The mineral collection is a choice and valuable one, the 4,500 specimens exhibited being but a tenth of the entire collection. The col-

lection is especially rich in rare and showy minerals of the Urals and the Tyrol. The collection is installed in vertical wall and "A" floor cases, the case interiors being colored maroon. The specimens are mounted on red or black walnut blocks. The meteorite cases are kept dry within by means of open dishes of sulphuric acid. For the deliquescent Stassfurt and other salts, a square jar, ground at the top to a bevel and fitted with a glass lid, is employed, and the specimens so installed show to much better advantage than in the usual museum jar. The collection of single crystals (a very large and choice collection) is shown in short "A" cases which have a steep slope and are fitted with narrow step shelves. By such an installation the eye of the observer can be brought close to the specimen, a most desirable arrangement for the study of objects so small. The crystals are mounted on wooden stands of the usual type. In the general collection index fingers are used freely on the specimens to point out individual crystals. The collection is divided into the terminological, systematic, genetic, and technological collections. In the terminological collection are illustrated structure, color, form, and luster of minerals, crystal form, growth of crystals, inclusions, crystal aggregates, and pseudomorphs. The systematic collection is arranged according to Groth's classification. The genetic series begins with the collection of meteorites, then follow rock-forming minerals and rocks, native salts, secondary minerals, and ores. The technological collection is intended to illustrate ores and minerals of economic importance with their products. There are shown in order ores of gold, mercury, silver, lead, tin, bismuth, antimony, zinc, iron, cobalt, nickel, manganese, and aluminium; then a series showing minerals used in the arts, such as materials for making glass, magnesite, strontianite, saltpetre, uraninite, chromite, borax, asphalt, ozocerite, asbestos, talc, mica, graphite, lithographic stone, Iceland spar, emery, tripoli, ornamental stones, and a series of gems showing the varieties of color exhibited by each species. Such a classification is well conceived and might be made most instructive if well executed, but, as is usual with such collections, insufficient care has been bestowed on the installation,

and many manufacturers' gifts have been introduced, so that the balance of the series is destroyed. A readable as well as exhaustive handbook, descriptive of the collection, is for sale by the attendant.

The paleontological collection is one of the largest in Europe. It is especially rich in mammals, reptiles, and fishes of North America. It is divided into three collections. In the first the fossils are arranged according to their biological order; in the second, according to their order in time; while the third is a local collection of fossils of Bavaria. Wall and floor cases of hard wood are used; the former of the usual type, the latter, desk cases with tops of a low slope. The smaller specimens are mounted on cardboard, the larger on bases of plaster or wooden blocks painted white. Most of the incomplete skeletons are restored, but a few, especially fishes and reptiles, are mounted upon wire frames, on which each bone has its proper place. While nothing especially novel in methods of installation was noted, the extent and variety of the material in this collection are such as to make it especially worthy of study. Among many specimens of great interest are a nearly complete skeleton of *Rhinoceros tichorinus*, found in a moraine near Ascham in Innthal; a complete skeleton of *Titanotherium trigonoceras*, and two skulls of the same genus; complete skeletons of the cave bear, of Rhinoceros and Hipparion, of Dinornis, and of many smaller species. Remains of an Ichthyosaurus from Boll, Würtemberg, show two young in the womb of their mother, thus giving proof of the viviparous character of the species. Other specimens show clearly the heterocercal tail. The fossils from the Solenhofen beds are superior in quality and quantity, some being remarkably vivid in their representation of ancient life. On one specimen may be seen tracks of a Limulus made for a short distance, and at the end the animal itself. Another specimen shows the trail of a mollusk made on the sand, ending with the mollusk itself.

Berlin: Naturhistorisches Museum. — The methods of installation employed in this museum have been so fully described by Dr. Hovey that little need be added. As in all other

museums which I saw constructed on the plan of galleries or halls around a central roofed court, the lighting is poor, so that much of the material cannot be seen satisfactorily. The rock collection, however, installed in flat floor cases, in a hall with side windows, is admirably lighted, and shows that such a combination may be satisfactorily used for obtaining good light. In the zoölogical halls, metal-framed cases, similar to those of the Dresden Museum, are employed. The same plan of group collections is also carried out, collections being exhibited which illustrate such features as varieties and differentiation of bone, skin, etc.

The Museum of the School of Mines adjoining has much important material and most of it well exhibited, but my time was too short to permit any study of its methods.

Zurich. — In the handsome Polytechnic Building are contained extensive geological and zoölogical collections, which are open to the public free one day in the week ; on other days admission is 50 centimes. The geological collection, built up chiefly by Professor Heim, is extensive and well cared for. The collections of minerals, rocks, and general geology are installed in floor cases of hard wood with sloping tops, no vertical wall cases being used. The collection here of greatest interest is that illustrating general geology. It is arranged upon a classification first proposed by Professor Heim, and is intended to illustrate the processes of formation, alteration, and decay which go on in the earth's crust. The classification, which is worth noting, is on the following page.

Each of these divisions is illustrated by specimens of the objects named, many of which are unique and striking. The proximity of the Alps has given an opportunity of which Professor Heim has made good use, for procuring the most vivid specimens. There are also shown, under each division, illustrations of the different phenomena as occurring in both recent and ancient time, as far as possible. Thus the collection as a whole gives a novel and effective presentation of the subject of general geology. The paleontological collection is large and well installed. Remains of the large quaternary mammals of

ROCK FORMATION.	ACTION OF AIR.	Surfaces polished by wind-blown sands, coloring and splitting produced by sun's heat, loess, fulgurites, etc.
	ACTION OF WATER.	CHEMICAL EROSION. Pittings on limestone, gypsum, etc.
		CHEMICAL ALTERATION. Kaolin, clay, limonite, serpentine, etc.
		CHEMICAL DEPOSITION. *a.* Dendrites, amygdules, geodes, etc. *b.* In springs. Travertine, siliceous sinter. *c.* In lakes. Clay-iron-stone, oölitic limestone. *d.* In seas. Gypsum, anhydrite, salt, etc.
		MECHANICAL DEPOSITION. River gravels, sand and silt; beach gravels, sand and silt; conglomerates, sandstones, etc.
		STRATA PHENOMENA. Mud cracks, ripple marks, rain-prints, etc.
		GLACIAL PHENOMENA. Glaciated pebbles, moraine materials, scored and polished surfaces.
	ACTION OF LIFE.	EROSION AND DEPOSITION BY PLANT LIFE. Rocks pitted by humus acids. Coal, peat, lignite, diatomaceous earth, petrified wood, etc.
		EROSION AND DEPOSITION BY ANIMAL LIFE. Rocks bored by mollusks. Animal remains, limestones, chalks, etc.
	ACTION OF THE EARTH'S INTERIOR.	Volcanic products, ashes, lavas, tuffs, etc.
ROCK DEFORMATION.		Folded and crumpled rocks, stylolites, slickensides, etc.

South America form a feature. Of these only the actual bones are mounted, no attempt being made to restore the missing parts. While this method has the advantage of truthfulness, it cannot be said to produce a pleasing effect. To see, for example, scattered limb bones, vertebræ, and ribs of a Megatherium, mounted in the upright position of the animal, but with no head, gives a grotesque and ludicrous impression rather than one calculated to encourage scientific study.

Bern. — The Natural History Museum, built by A. Jahn in 1879–81, is a handsome stone building of three stories. The mineralogical and paleontological collections occupy the ground floor, the zoölogical the two upper floors. The alcove system of installation is employed and good lighting is secured. Both installation and labeling are neat and careful throughout, and one has a general sense of comfort and satisfaction in looking through the museum. Of greatest interest is the magnificent collection of crystals from the St. Gothard. One perfectly clear crystal of smoky quartz is 3½ feet long and 2 feet in diameter; another, doubly terminated, is 4 feet long. There are also large and showy groups of albite from the same region and of epidote from the Untersulzbachthal. Of interest in the paleontological collection are perfect skeletons of the cave bear and Irish elk. The museum is open free three hours a day on Tuesdays, Saturdays, and Sundays; on other days admission is one franc.

Neuchâtel. — The natural history collections exhibited in the Collége Latin are extensive and of permanent interest for their association with the memory of the great naturalist who founded them. The collection of fishes is unusually large, as is also the collection of marbles. The animal groups by Challande are also unique and attractive and embody an idea which one could wish to see more widely carried out. The installation is, however, in general antiquated, and while perhaps the best that funds will allow, furnishes an impressive illustration of the advance in museum methods since this collection was established. The cases employed are flat-topped floor cases and

vertical wall cases. They are painted white and the panes are of small size. The bases of the wall cases are so high that the specimens are almost out of sight. The halls are lighted by side windows. The museum is open to the public only six hours a week — four hours on Thursdays and two hours on Sundays.

Paris: Muséum d'Histoire Naturelle and *École des Mines.* — I have little to add to Dr. Hovey's admirable account of these museums. Nothing could better illustrate the advance which has taken place in museum methods in the last thirty years than to contrast the mineralogical museum in the Jardin des Plantes, having varied modes of installation, confused arrangement and cheaply framed cases, with the new paleontological museum having cases almost wholly of glass, and collections made up of consecutive series of exquisitely prepared and carefully labeled specimens. Similarly the advance which has been made in methods of collecting and in an understanding of what constitutes a "specimen" is well evinced by a comparison of the Haüy collection in the mineralogical museum, made up as it is of many insignificant fragments, with any decent mineral collection of to-day. Such contrasts show clearly how great are the possibilities of museum representation and the need of constant study for its improvement. Of single features, the notices to the public which take the place of the rude English "Hands off" or "Touch not" deserve imitation. They read as follows:

"Les pièces de cette galerie, étant très fragiles, sont confiées à la garde du public. On est prié de ne pas y toucher." (The specimens in this hall, being very fragile, are confided to the care of the public. It is requested that they be not handled.)

The museums of the Jardin des Plantes are open Sundays and Thursdays from 11 to 4, and by ticket on Tuesdays, Fridays, and Saturdays for the same hours. The École des Mines collections can be seen only Tuesdays, Thursdays, and Saturdays from 1 to 4.

London: British Museum (*Natural History*). — The character of this great museum and the methods of installation

employed are so generally known that any detailed description would be superfluous. The possibilities of a museum as an institution seem here to be as fully realized as is possible in the present state of museum knowledge. The well-lighted building, the extensive collections along all lines of natural history, the rich and careful installation, the perfect neatness, the complete labels, and the clear and comprehensive handbooks, all combine to show what a museum can do as a great storehouse of instruction.

Of single features the mount of jeweler's cotton for mineral specimens is worthy of note. It furnishes a neutral background and does not show dust. Instead of being described as forced into a groove, as Dr. Hovey has it, however, it should be said that the cotton is folded around a cardboard which fits the tray. This makes in one sense a groove, but is an easier mode of manipulation than the other. This mount is not used for all specimens where another background would give a better effect. Specimens of *flos ferri*, for instance, are mounted on purple velvet. Single gems are exhibited in shallow cups of celluloid. The crystal mounts are ebonized, conical bases tapering to a long slender rod, on the end of which the crystal is fastened. The rod, it may be said, is too long to suit the writer's taste. In labeling the species, if there are a number of specimens from different localities, only the locality is given on the specimen label; the species' name is shown on a label raised on a brass support and placed in the center of the group. The low installation employed for the mineral collection, while perhaps giving the best lighting to the specimens, to the writer's mind, does not make for the hall so attractive an appearance as could be obtained by the use of cases which would give a glimpse of their contents at a distance. The exhibition of specimens at the bottom of desk cases, at any rate, seems entirely useless. The meteorites are exhibited in pyramidal "A" cases fitted with a pyramidal series of shelves. The specimens are mounted on mahogany bases. The instructive collections introductory to the study of rocks, minerals, and meteorites deserve the highest praise. Wrought out in exquisite detail, the labels couched in clear and simple language, and with

every possible feature illustrated by specimens, the collections serve in the highest degree to show what such productions can do as mediums of instruction. In the paleontological collection vertical cases arranged on the alcove system are employed, interspersed with pyramidal "A" cases, in which the smaller specimens are shown. Every effort is put forth by the use of photographs, wash drawings, models, and descriptive labels to make the collections instructive. In connection with the vertebrate fossils there are even exhibited mounted skeletons of the modern elephant, rhinoceros, etc., in order to make clear by comparison the structure of the ancient mammals. Such an exhibit is most admirable but is possible, of course, only to museums of the largest size.

Museum of Practical Geology, Jermyn Street. — The plan of the museum building is that of tiers of galleries around a central roofed court. The lighting from above causes bad reflections in the flat cases around the court. The vertical cases are better lighted, but are narrow, necessitating upright installation, which is often inconvenient. The practical purposes of the museum have been kept in mind in the make-up of the collections, but, as seems often to be the case, the collections gathered on scientific lines are outgrowing those of economic interest. Among methods of installation I noted specially the mode of exhibiting maps. They are hung rolled on spring rollers from the edge of the gallery, whence a descending tassel permits the visitor to draw the map down for examination. Space is thus economized and the maps are better preserved. The large slabs of Ichthyosaur and Plesiosaur remains are framed and covered with glass, thus enhancing the appearance of the specimens and serving for their better preservation. An excellent handbook to the museum makes a study of the collections easy and interesting.

British Museum. — I have but a single note to quote of this museum, though much might be said of it in approval. Gems are displayed by being set in a frame placed in the outer part of a case with sloping sides, in the interior of which mirrors are

placed so as to reflect light *through* the stone. Thus the true color and luster of the stone are displayed as they could not be against an opaque background.

Oxford. — There is much valuable material in the geological collections of the University Museum, but it is largely hidden by the installation. The great series of Lyme-Regis specimens and much of the Prestwich collection, being piled in dark, deep wall cases and with few labels, are of little use to visitors. The minerals and rocks, now being installed in flat cases, show a beginning of better things, but the table cases used have a temporary look at best.

Bath. — The collections of the Moore Geological Museum owe their origin chiefly to the labors of Mr. Charles Moore. They are largely illustrative of the geology of the surrounding district, and of this field give an excellent representation. The display of Ichthyosaur and Plesiosaur remains is especially fine and probably unsurpassed outside of the British Museum. Here also are the remains of the diminutive *Microlestes*, which were found by carefully picking over three tons of clay. Wall cases and a gallery are the method of installation employed in one of the halls, while floor desk cases with tops of low slope occupy another. Most of the specimens are exhibited in pasteboard trays. The arrangement is primarily stratigraphical, and under each stratigraphical division zoölogical. The boundaries of each stratigraphical division are indicated by wide mahogany sticks, and those of the zoölogical groups by narrower black sticks. Figured specimens have green labels. A box of suggestive shape, with a suggestive slot and suggestively near the exit, is labeled "Contributions to the geological collection," thus making a not unreasonable request that those who derive instruction from well-arranged and well-cared-for collections shall contribute toward their maintenance.

Bristol. — The zoölogical collection is upon the ground floor, the geological upon the second floor of the building, modeled after the Doge's Palace in Venice, which constitutes the home

of the city library and museum. The model is hardly one worthy of imitation in museum architecture, especially on account of the outer arcade, which, though it doubtless adds to the beauty of the building, cuts off much of the light so essential to museum display. The geological collection is installed in floor desk cases. The fossils and minerals shown are chiefly local, but the region is one exceptionally rich in its representation of the strata of different ages. Type specimens are indicated by disks of yellow paper, figured specimens by green. Casts and maps are hung about to some extent. The minerals are grouped in an unusual fashion, the divisions being silica, silicates of alumina, lime minerals, and metallic ores with iron. This may be better than no grouping at all, but it cannot be said to teach anything of value. The installation as a whole shows lack of care, the case interiors being dusty and the specimens likewise. The labels are written with poor ink and many are hardly legible. Hence while there are many rare and showy specimens in the collection, and while the lighting of the upper floor at least is good, one is soon overcome by "the musty feeling," which, though once supposed to be a necessary concomitant of museums, now, happily, survives in but few.

Edinburgh. — The Museum of Science and Art combines the functions which its name indicates. The first-named function is apparently the more prominent, but the combination with the second (made to include industrial art) gives a pleasing character. It is one of the few museums which have succeeded with the experiment of evening opening. The evening attendance indeed is larger than that in the daytime. The hours of visiting are from 10 A.M. to 10 P.M., free on Mondays, Wednesdays, and Fridays. On other days admission is sixpence. The plan of the museum building seems unfortunate in some respects, as it is of the type which has been not unaptly termed "well construction," *i.e.*, tiers of galleries round a central roofed court. In such a building few visitors are likely to climb to the upper floors, and the lighting of many of the halls is necessarily poor. In the collections exhibited much attention is

paid to what is practical as well as scientific. There are many models shown, many illustrations of industrial processes, and many illustrations of the uses to which natural products can be put. There are many styles of cases employed, though perhaps not of choice. A combination of half of a flat and half of an upright case is much used for a wall case, though vertical wall cases are being gradually used to replace these. The latter cases are fitted with plate-glass shelves, which rest on *T*-shaped bars extending across the case and capable of being adjusted in height by fitting into a series of slots in wall plates which run vertically. The door jambs of the cases are fitted with velvet, against which the door is screwed by bolts at top and bottom, turned with a hand wrench, so as to effectually keep out dust. A pyramidal floor case, about 8 feet long, 2 feet wide, and 7 feet high (the base and legs being 2 feet high), is used in the hall of Scottish minerals. The form of the case cannot be said to be altogether attractive, but the lighting of the specimens is admirable. The shelves in this case are fastened to a central upright partition. The arrangement of the collection of fossils is wholly zoölogical. The mineral collection is classified on Dana's system. Several halls are devoted to a representation of the geology of Scotland, to illustrate which and the work of the Geological Survey, an exhaustive collection has been prepared. Maps of each district are shown, and in the adjoining cases are elaborate series of the rocks or fossils of the district. Photographs and transparencies, showing photomicrographs of the rocks, also add to the completeness of the exhibit. An extensive collection of the minerals of Scotland is also shown. An aquarium hall containing living fish attracts much popular attention.

General Conclusions. — If a museum building is on more than one floor or has its halls arranged in any other way than to favor a consecutive line of progress, the upper floors and side halls will not receive equal attention from visitors. If the building is of several stories, the windows should be high and face without; the plan of tiers of galleries around a central roofed court has many disadvantages.

Cases should be of uniform pattern (units) if possible. Their form will be determined by the lighting of the building. If this light is from above, vertical wall and floor cases should be used; if from the side, cases with flat or sloping tops. Metal framework for the cases has the advantages of tenuity and durability. All specimens should be cased, both for purposes of preservation and attractiveness. No pains or means should be spared to make installation rich, neat, and attractive; the most valuable material may be rendered practically worthless for museum purposes by poor installation, and *vice versa*.

The indefinite extension of synoptic or systematic collections is not a desirable effort for a people's museum. Such collections weary by their monotony and extent without teaching any adequate lesson. Group collections formed about some commonly understood idea are more attractive and instructive. To make such collections requires more time, thought, and care than to string out genera and species, but they are more than correspondingly valuable. The economic relations of things can, at least, be shown without much effort, but if this is done, care should be taken that classification is adhered to closely, and the collection kept well balanced.

Museums should cultivate home fields and aim to represent most fully the materials of their own districts in the same proportion and for the same reason that local interests and acquaintances are larger and more important than those at a distance. Thus the best collection of the fossils of the Paris basin should be, as it is, in Paris; of the minerals of Cornwall, in the British Museum; of Prussian amber, in the Berlin Museum.

As to form and style of labels, there can be little question of the superiority of the printed label, made as descriptive as possible. Case labels are very desirable, since they serve, like the headlines of a newspaper column, to show at a glance the character of the contents. In the Continental museums the need of labeling seems to be less generally recognized than in those of Great Britain and our own country. Specimens often have no label, and if they do have labels, they are usually simple statements of name and locality written on paper.

The Continental museums are also open for but remarkably few hours to the public. To illustrate this I have taken the trouble to quote the hours of a number in the preceding pages. Both of these peculiarities indicate that the old conception of a museum as a storehouse still predominates on the Continent. Yet the possibilities of a museum as a medium of public instruction, which are at present probably best understood and exemplified in the museums of Great Britain and America, are fast becoming appreciated on the Continent as well.

In conclusion, I have no better word than to quote a sentence spoken to me in conversation by Dr. Traquair, the able Keeper of the Natural History Collections of the Edinburgh Museum: "The first duty of a scientific museum is to teach science; of a curator, to preserve his specimens."

ON SOME CHANGES IN THE NAMES, GENERIC AND SPECIFIC, OF CERTAIN FOSSIL FISHES.

O. P. HAY.

THE writer desires to call the attention of paleontologists to the following changes, which it seems to be necessary to make in the nomenclature of certain fossil fishes. Nearly all these changes pertain to North American species or to genera represented in North America. While there may appear to be a considerable number of names which have been replaced by others, there are in reality few, when compared with the large number of species whose history has been studied. While it is to be regretted that old and well-known names have to be cast aside and new or unfamiliar ones substituted, the writer believes that it is better to reform nomenclature as soon as errors are discovered than, by repeating them, to make more difficult of accomplishment what must be done at some time by somebody.

In 1875[1] St. John and Worthen described a species of Cladodus which they called *C. carinatus*. The same name was employed in 1889 by Dr. Newberry[2] for an entirely distinct species. This requires, therefore, a new name, which may be *C. coniger*.

In 1894 Professor E. W. Claypole[3] described a supposed species of Cladodus which he designated as *C. (?) magnificus*. The name is, however, preoccupied, Tuomey having in 1858[4] described a *C. magnificus* from the state of Alabama. The former species may be named *C. claypolei*, in honor of the describer.

In 1891[5] Professor Cope described a fossil tooth which he called *Hybodus regularis*. However, the specific name is pre-

[1] *Geol. Surv. Ill.*, vol. vi, p. 279, Pl. IV, Figs. 6 and 7.
[2] *Palæoz. Fishes N. A.*, p. 103.
[3] *Amer. Geol.*, vol. xiv, p. 137, Pl. V.
[4] *Second Report Geol. Alabama*, p. 39.
[5] *Proc. U. S. Nat. Mus.*, vol. xiv, p. 448, Pl. XXVIII, Fig. 2.

occupied, having been applied to a Hybodus by Reuss in 1846.[1] The first-mentioned species may be renamed *H. copei*.

In 1866[2] Newberry and Worthen described, from the Burlington limestone of Iowa, a tooth which they called *Helodus compressus*. This species is now regarded as belonging to the genus Hybocladodus. In 1870[3] the same writers described another *Helodus compressus*, from the same horizon, in Illinois. In renaming the latter species I shall, by calling the fossil *H. wortheni*, endeavor to honor the director of one of the most creditably conducted of our state geological surveys.

The name Stemmatodus was applied in 1875[4] by St. John and Worthen to certain bodies which they regarded as teeth of shark-like animals, but which may be, as Mr. A. S. Woodward has suggested, dermal denticles. The name had, however, been employed by Heckel in 1856 for a genus of pycnodont fishes. Clearly the name, as employed by St. John and Worthen, must yield to some other term. I propose STEMMATIAS. The type will be *Stemmatias cheiriformis* St. John and Worthen. The recognized species are *S. bicristatus*, *S. bifurcatus*, *S. compactus*, *S. keokuk*, and *S. symmetricus*, all described by the authors referred to.

The name Goniodus was employed by Agassiz[5] in 1838 to designate a genus of sharks which had previously been called by Blainville Echinorhinus. Being therefore a synonym of Echinorhinus, it is not available as the name of any other genus. Nevertheless, it was in 1889 applied by Newberry[6] to certain pavement-like teeth from the Huron shales of Ohio. As a substitute for Dr. Newberry's name, Mr. S. A. Miller, in 1893,[7] proposed the name Xenodus. The type and only known species is *X. hertzeri* (Newberry).

In 1862[8] Morris and Roberts applied one of Agassiz's manu-

[1] *Verstein. böhm. Kreidef.*, pt. ii, p. 98.
[2] *Geol. Surv. Ill.*, vol. ii, p. 78, Pl. V, Fig. 1.
[3] *Geol. Surv. Ill.*, vol. iv, p. 360, Pl. III, Fig. 15.
[4] *Geol. Surv. Ill.*, vol. vi, p. 328.
[5] *Poissons Foss.*, vol. iii, p. 94.
[6] *Palæoz. Fishes N. A.*, p. 67.
[7] *N. A. Geol. Palæont.*, 1st App., p. 718.
[8] *Quar. Journ. Geol. Soc.*, vol. xviii, p. 101.

script names, Xystrodus, to a species which had in 1855 been described and figured as *Cochliodus striatus* by McCoy. The name therefore must date from 1862. But in 1860 Plieninger[1] described with some minuteness some Hybodont teeth, to which he gave the name *Xystrodus finitimus*. This earlier use of Xystrodus makes it impossible, or at least unwise, to use it in the sense given it by Morris and Roberts. The name PLATYXYSTRODUS may be used instead. The type will be as before, *P. striatus* (McCoy). The American species are *P. bellulus*, *P. imitatus*, *P. inconditus*, *P. simplex*, and *P. verus*, all by St. John and Worthen.

In 1883[2] Davis founded a genus of cochliodont sharks, to which he gave the name Tomodus. The name had, however, been used for other teeth in the same group by Trautschold in 1879.[3] It was, therefore, clearly preoccupied. Subsequently Trautschold renamed his genus Oxytomodus, but this in no way made Tomodus more available for Davis's genus. On this point see Mr. A. S. Woodward's remarks.[4] For the genus described by Davis, S. A. Miller[5] has proposed to substitute Icanodus. The type will, of course, be *I. convexus* (Davis). One American species belongs doubtfully to the genus. This is *I.* (*?*) *limitaris* (St. John and Worthen).

In 1843[6] H. von Meyer described, from the lower Miocene of Hesse Darmstadt, a species of ray which he called *Myliobatis serratus*. Leidy,[7] therefore, encroached on occupied territory when he named a fossil ray from the Eocene of New Jersey *M. serratus*. This may be called *M. leidyi*.

Two species of fossil Dipnoi require new names. In 1877[8] Professor Cope described remains which he denominated *Ctenodus gurleyanus*. In 1889 S. A. Miller[9] modified the specific

[1] *Neues Jahrb. Min.*, p. 695.
[2] *Trans. Roy. Dublin Soc.*, [2], vol. i, p. 446.
[3] *Nouv. Mém. Soc. Imp. Nat. Moscou*, vol. xiv, p. 55.
[4] *Cat. Foss. Fishes*, vol. i, p. 191.
[5] *N. A. Geol. Palæont.*, 1st App., p. 716.
[6] *Neues Jahrb. Min.*, p. 703.
[7] *Proc. Acad. Nat. Sci. Phila.*, p. 395.
[8] *Proc. Amer. Philos. Soc.*, vol. xvii, p. 54.
[9] *Palæoz. Foss. N. A.*, p. 593.

name to *gurleianus*. In 1891[1] Mr. Woodward referred the species to Sagenodus. In a posthumous paper, published in 1897,[2] Cope described as a new species another *Sagenodus gurleianus*. This evidently requires a new name. I propose *S. textilis*.

In 1889[3] Newberry described a dipnoan tooth, which he called *Dipterus* (*Ctenodus*) *radiatus*. But the name is preoccupied. Eichwald in 1844[4] described a *C. radiatus*, and in 1858[5] this was referred by Pander to the genus Dipterus. Newberry's species may be called *D. contraversus*.

The genera which have been known as Rhizodus and Megalichthys are particularly exasperating cases from the point of view of nomenclature, and I regret that it appears necessary to deal with them. Megalichthys is credited to Agassiz and Hibbert, and was apparently first proposed in a paper published by Hibbert in 1836.[6] The only species there described is *M. hibberti*, although another, *M. falcatus*, is mentioned. The age of the enclosing rocks is Lower Carboniferous. The genus and species are clearly based on the materials collected at Burdiehouse, near Edinburgh, although the descriptions are clouded somewhat by Agassiz's knowledge of the remains of a different fish found in the museum at Leeds. This was derived from the coal measures, and Agassiz regarded it as identical with the Scottish specimens. When in 1844[7] Agassiz came to describe *M. hibberti*, he based his description on the Leeds specimens; and since that time the name has adhered to the coal-measures species. It is evident that the name must be restored to the Scottish types. The latter were figured by Buckland in 1837,[8] partly under the name of *M. hibberti* and partly as *Holoptychus hibberti*. Owen in 1841[9] imposed on these Scottish specimens

[1] *Cat. Foss. Fishes*, vol. ii, p. 261.
[2] *Proc. Amer. Philos. Soc.*, vol. xxxvi, p. 82, Pl. I, Fig. 9.
[3] *Palæoz. Fishes N. A.*, p. 119, Pl. XXVII, Fig. 33.
[4] *Bull. Soc. Imp. Nat. Moscou*, vol. xvii, p. 827.
[5] *Ctenopdipt. Devon. Syst.*, p. 22.
[6] *Trans. Roy. Soc. Edinb.*, vol. viii, pp. 169–282, Pls. V–XII.
[7] *Poissons Foss.*, vol. ii, pt. ii, p. 89, Pls. LXIII, LXIV.
[8] *Geol. and Mineral.*, ed. 2, vol. ii, p. 43, Pl. XXVII.
[9] *Odontography*, vol. i, p. 75.

the name *Rhizodus hibberti*, and the name has clung to them ever since.

Evidently all the species which have been marshalled under the name Rhizodus must be placed under Megalichthys of Agassiz and Hibbert. The British species are *M. hibberti* Agassiz and Hibbert and *M. ornatus* Traquair. The American species are *M. augustus* (Newberry), *M. incurvus* (Newberry), *M. lancifer* (Newberry), and *M. occidentalis* (Newberry and Worthen).

What, then, must be done with the species which have been masquerading under Megalichthys of Agassiz (1844)? The first generic name applied to any of this group of species after 1844 was Centrodus, given by McCoy [1] (1848). This, however, is preoccupied, having been applied to some fossil elasmobranch teeth by Giebel in 1847.[2] The next name in order of time is apparently Parabatrachus, proposed by R. Owen in 1853.[3] This was given to a portion of the skull of an animal, which Owen regarded as batrachian, near Archegosaurus, but which is now identified with Megalichthys of Agassiz (1844). The type species is *P. colei*, but this is now regarded as identical with *M. hibberti* Agassiz (1844). It may not at first thought be pleasing to our ideas of propriety to accept this name for a fish, but we must remember that one of our common marine fishes bore for a long time the generic name Batrachus.

What specific name is the species described by Agassiz in 1844 to bear? It cannot be *hibberti*, because the name *M. hibberti* had in 1836 been applied to another species. This will furnish some compensation for the disadvantages resulting from changes, because the name has been a source of confusion, and because Hibbert had nothing to do with it, except to speak of it incidentally. The earliest name given in the synonomy of the species by Mr. Woodward [4] is one of Agassiz's names, *maxillaris*.[5] If our conclusions, then, are correct, the fish which

[1] *Ann. Mag. Nat. Hist.*, [2], vol. ii, p. 3.
[2] *Fauna Vorwelt; Fische*, p. 344.
[3] *Quar. Journ. Geol. Soc.*, vol. ix, p. 67.
[4] *Cat. Foss. Fishes*, vol. ii, p. 378.
[5] *Poissons Foss.*, vol. ii, pt. ii, p. 96.

in all recent works has been known as *M. hibberti* becomes *Parabatrachus maxillaris* Agassiz. Other British species are *P. coccolepis* (Young), *P. intermedius* (Woodward), *P. laticeps* (Traq.), *P. pygmæus* (Traq.), and *P. lævis* (Traq.). The American species are *P. nitidus* (Cope), *P. ciceronius* (Cope), and *P. macropomus* (Cope). *P. maxillaris* possibly also occurs in this country. *P. nitens* (A. Fritsch) occurs in Bohemia.

Certain well-known genera and one species of pycnodont fishes bear names that are not tenable.

In 1872[1] Dr. Leidy described a pycnodont, which he named *Pycnodus faba*. But already in 1847[2] H. von Meyer had given the same name to remains from the Eocene of Germany. Leidy's species may then be given the name *P. phaseolus*, in allusion to the resemblance of the larger teeth to the pods of the wild bean, Phaseolus.

As Mr. A. S. Woodward tells us,[3] the generic name Microdon, which has been used so long for a genus of pycnodonts, being proposed by Agassiz in 1833,[4] had been used previously in entomology by Meigen in 1803. It is, I am informed, now in current use as a genus of Diptera. If this name may be employed in both ichthyology and in entomology, its seems reasonable that the conchologists may be allowed to resurrect Conrad's Microdon; and we might then discuss the question whether the fish Microdon subsisted wholly on such mollusks as Microdon, or occasionally varied its diet by adding such Diptera as Microdon. I regard it as subversive of the purposes of scientific nomenclature to perpetuate the use of such preoccupied names. As I find no synonym of Agassiz's Microdon which may take its place, it becomes necessary to propose a new name. This is POLYPSEPHIS, from *πολυψηφίς*, *with many pebbles*, in allusion to the numerous rounded teeth. No American species are at present referred to this genus.

Mesodon of Wagner (1851)[5] is not available in ichthyology,

[1] *Proc. Acad. Nat. Sci. Phila.*, p. 163.
[2] *Neues Jahrb. Min.*, p. 186.
[3] *Cat. Foss. Fishes*, vol. iii, p. 221.
[4] *Poissons Foss.*, vol. ii, pt. i, p. 16.
[5] *Abhandl. k. bay. Akad. Wiss., math.-phys. Cl.*, vol. vi, p. 56.

having been used by Rafinesque for a genus of mollusks in 1819. According to Mr. Woodward,[1] Typodus of Quenstedt (1858) is probably identical with Mesodon of Wagner. It is therefore accepted provisionally as the generic name of those pycnodont fishes which have hitherto been called Mesodon. The American species will be *T. abrasus* (Cragin), *T. dumblei* (Cope), and *T. diastematicus* (Cope).

The genus Catopterus Redfield cannot be retained in the sense now given it. It was proposed by J. H. Redfield in the year 1837.[2] In his paper he states that the name had been used by Agassiz originally for a very different fish; but since Agassiz's Catopterus had been reduced to synonomy, Redfield evidently thought that he was at liberty to use it again. Any one who has had experience in systematic work has soon learned how much confusion this practice produces. Few naturalists would now, I think, defend this practice, even though they may accept such preoccupied names on account of their long standing. Agassiz's Catopterus is a synonym of Dipterus. For the species which have been included under Catopterus of Redfield, no other generic name has, so far as I know, been proposed. I therefore offer the new name REDFIELDIUS, in honor of William C. Redfield and John Howard Redfield, father and son, two of the early students of American palæichthyology. The type of the genus will be, as before, *R. gracilis* (Redfield). The other recognized species are *R. anguilliformis*, *R. minor*, *R. ornatus*, *R. parvulus*, and *R. redfieldi*. The change of name of the genus will abolish Catopteridæ as the name of the family. It may be replaced by Dictyopygidæ from Dictyopyge, the other genus of the family.

The name Eugnathus, by which a well-known group of fossil fishes has long been known, must give way to some other term. Eugnathus, as a name for fishes, was first employed by Agassiz in 1844,[3] the type species being *E. orthostomus*. However, the name had been used as early as 1834 by Schönherr for a genus

[1] *Cat. Foss. Fishes*, vol. iii, pp. 199, 215.
[2] *Ann. Lyc. Nat. Hist. N. Y.*, vol. iv, p. 39.
[3] *Poissons Foss.*, vol. ii, pt. ii, p. 97.

of curculionid beetles, and is in current use. So far as I can determine, the next name in succession is J. W. Davis's Lissolepis[1]; but this is preoccupied, having been imposed on a genus of lizards by Peters in 1872. The next name in order seems to be Zittel's Isopholis.[2] Zittel does not indicate the type of his genus; and the first species named under it, *crenulatus*, is not, according to Mr. Woodward,[3] a member even of the same suborder. The position of *I. münsteri*, the species figured, is also doubtful. However, these may be removed and the genus allowed to rest on the species remaining; and as type of Isopholis we may take the species described by Agassiz as *Pholedophorus longiserratus*, it being also one of the species included by Zittel in his Isopholis. The family name Isopholidæ may be derived from this genus.

In 1849,[4] and again in 1852,[5] Roemer defined from manuscript of Debey a new genus of fishes, which he called Ancistrodon. The generic name cannot in my opinion stand, being practically preoccupied by Agkistrodon, proposed in 1799 by Palisot de Beauvois.[6] Although differing in form, the two names are merely different ways of transliterating the same Greek words. Furthermore, many authors have written the ophidian generic name Ancistrodon. Professor S. F. Baird so spelled the word as far back as 1859. Unless we are prepared to adopt the recently suggested rule to regard as eligible all names which differ by a single letter, no matter how that difference has been produced, we must, I think, abandon Ancistrodon as a generic name in ichthyology. In its place I offer the name GRYPODON, from γρῦπος, *hooked*, and ὀδών, *tooth*. The type of the genus is *G. texanus* Dames. Other species described[7] are *G. mosensis* Dames, *G. lybicus* Dames, *G. armatus* Gerv., *G. vicentinus* Dames.

I have already referred to S. A. Miller's First Appendix to

[1] *Ann. Mag. Nat. Hist.* (1884), vol. xiii, p. 448.
[2] *Handb. Palæont.*, vol. iii, p. 216.
[3] *Cat. Foss. Fishes*, vol. iii, p. 463.
[4] *Texas*, etc., p. 419.
[5] *Kreidebild. von Texas*, p. 30.
[6] *Trans. Amer. Philos. Soc.*, vol. iv, p. 381.
[7] Dames, W. *Zeitschr. deutsch. geol. Ges.*, vol. xxxv (1883), pp. 656–670.

his *North American Geology and Palæontology*. This Appendix was issued about the beginning of the year 1893, and contains a number of new names which were proposed as substitutes for preoccupied generic names of fishes. These are, omitting those already mentioned, as follows: Eczematolepis for Acantholepis Newberry; Tegeolepis for Actinophorus Newberry; Ponerichthys for Dinichthys Newberry; Dissodus for Diplodus Agassiz; Haplolepis for Eurylepis Newberry; Gamphacanthus for Heteracanthus Newberry; Lispognathus for Liognathus Newberry; Millerichthys for Pterichthys Agassiz; Oestophorus for Sphenophorus Newberry.

Most of these names proposed by Miller must, I think, be accepted, but not all. For Diplodus, which is manifestly preoccupied, Dissodus is not required, since there is a number of available synonyms of Diplodus. Of these Dittodus (Owen[1]) is probably to be preferred. In proposing Ponerichthys to replace Dinichthys Miller labored under a misapprehension. The genus Dinichthys was founded by Dr. Newberry in 1868,[2] being based on the species *D. herzeri*. In the same year Prof. C. H. Hitchcock[3] published an account of Dinichthys, but it was a report of Newberry's discovery, and the author made no pretense of claiming credit for the name. In any case, there is no demand for a new name since the Dinichthys of both writers was based on the same species.

As regards Pterichthys, there is no getting around the fact that the name as employed by Agassiz in 1844 is preoccupied. Swainson in 1839[4] first applied the name to a group of recent fishes, defining it and referring to it a number of recognized species. But Millerichthys, proposed in honor of Hugh Miller, is superfluous, as well as devoid of euphony. Peter Bleeker as long ago as 1859[5] had perceived that the Pterichthys of Agassiz was antedated, and by a lucky stroke of his pen had parenthetically proposed Pterichthyodes in its place. This

[1] See A. S. Woodward's *Cat. Foss. Fishes*, part i, p. 2.
[2] *Proc. Amer. Assoc. Adv. Sci.*, 16th meeting, p. 146.
[3] *Geolog. Mag.*, [1], vol. v, p. 184.
[4] *Nat. Hist. and Class. Fishes*, etc., ii, p. 265.
[5] *Enum. Spec. Pisc. Arch. Ind.*, Tentamen, p. 11.

name does not appear anywhere else, so far as I know, and I am indebted for my knowledge of it to Dr. T. N. Gill, who is so thoroughly informed on all that pertains to the classification of fishes.

For information regarding the status of the generic names mentioned in this paper as being employed in entomology, I am indebted to Messrs. Ashmead and Schwarz of the department of entomology in the U. S. National Museum.

THE UTILITY OF PHOSPHORESCENCE IN DEEP-SEA ANIMALS.

C. C. NUTTING.

In a paper entitled "The Color of Deep-Sea Animals," read at the last meeting of the Iowa Academy of Sciences, I brought together a number of facts tending to show that the actual quantity of phosphorescent light emitted by animals of the deep sea was very considerable; so great, indeed, as to supply over definite areas of the sea bottom a sufficient illumination to render visible the colors of the animals themselves. If this be true, we have an explanation of the colors themselves along the same lines as are adopted in discussions of animal coloration in general. Coloration is practically meaningless in the absence of sufficient light to make colors visible. Having explained the colors of deep-sea forms by demonstrating a light in the depths sufficient to render visible the prevailing bright colors, *i.e.*, reds, yellows, and greens, of the animal inhabitants, it is interesting, and may be profitable, to seek an answer to the question: "Of what profit is the phosphorescence to its possessors?"

I must confess to having scant sympathy with those naturalists who delight in demonstrating, to themselves at least, the falsity of the good old Darwinian dictum that "every character possessed by an animal is of use to the species, or was of use to its ancestors." Men nowadays are willing to assert boldly that certain characters of animals are "meaningless."

For instance, Beddard, in his *Animal Coloration*, p. 37, says: "The inevitable conclusion, therefore, from these facts appears to be that the brilliant and varied colorations of deep-sea animals are totally devoid of meaning. They cannot be of advantage for protective purposes, or as warning colors, for the single and sufficient reason that they are invisible."

Again, one of our own writers, Dr. Walter Faxon, in his work on the stalk-eyed Crustacea secured by the *Albatross* (p. 253), says, in reference to the red color of the deep-sea Crustacea: "This color, then, is to be regarded as entirely useless to its possessor," and concludes that because certain species turn red when placed in the dark, he can explain the red color of deep-sea forms as a purely physical result of their environment.

Now I, for one, am unwilling to surrender the original Darwinian proposition. Of course there are many things yet to be explained, or even inexplicable with our present knowledge. But this does not justify the unqualified use of such terms as "meaningless" and "useless."

It is the purpose of this paper to explain cases in which phosphorescent light is emitted by animals, in terms of its use to the animals themselves.

To this end we can conveniently divide the inhabitants of deep water into *free-swimming* and *fixed* forms. In the former class would be all of the fishes, nearly all of the Crustacea, most Mollusca, Vermes, and Echinodermata, part of the Cœlenterata, and most of the Protozoa.

It will also simplify matters to remember that practically all deep-sea forms live on animal food. Among the fishes are several, allied to Lophius and Antennarius, which are provided with a bait said to be luminous, which serves to attract the prey. Others are luminous along the lateral line in definite spots. The utility in this case is not certainly known, but two suggestions may be made, one to the effect that the light attracts the mate and thus serves the purpose of *attractive coloration;* the other that it attracts the prey and serves the purpose of *alluring coloration.*

A very large number of crustaceans are phosphorescent, often brilliantly so. Many of these have large eyes, and are particularly active in movement and voracious in appetite. They feed on minute organisms, for the most part, and it can hardly be doubted that they often use their phosphorescent powers for the purpose of illuminating their surroundings and revealing their prey. Here again it is probable that the

strangely attractive power of light serves a definite purpose in the life economy of the animal.

Among the Mollusca we have few instances, so far as I know, of phosphorescent organs. Lamellibranchs, however, are largely vegetative, impassive animals. The Gastropoda are more active, but still slow in movement compared with most animals. Among the Cephalopoda are a number of highly specialized and swift-moving forms, and here, if anywhere among mollusks, we should expect to find phosphorescent organs. At the Detroit meeting of the American Association, Professor William E. Hoyle, of England, read an exceedingly interesting paper on certain organs possessed by Cephalopoda secured by the *Challenger*. These organs were regarded as phosphorescent by Professor Hoyle, who described a highly specialized apparatus designed to reflect light from the phosphorescent bodies downward to the bottom over which the animal passed. In this case it appears that there is not only a light, but also a reflector, an efficient "bull's-eye" lantern for use in hunting through the abyssal darkness. Among Vermes are many forms possessing a high degree of light-emitting power, which may be either attractive, alluring, or directive in function, and thus of direct advantage to its possessors.

Most of the echinoderms, although not truly fixed, are not capable of rapid locomotion. Perhaps the most active animals of this group are the serpent stars, some of which are able not only to crawl rapidly, but actually to swim with considerable facility. It is therefore interesting to note that the only phosphorescent echinoderm that I can find any account of belongs to the Ophiuridæ, and is described by Agassiz as "exceedingly phosphorescent, emitting at the joints along the whole length of its arms a bright, bluish-green light." Its utility can only be conjectured. If, as in the case with many of its allies, its life is spent crawling among the branches of phosphorescent gorgonians, the protection thus secured would certainly be advantageous.

Coming now to the Cœlenterata, we find many notably phosphorescent organisms. The ctenophores and medusæ comprise the greater part of the free-swimming members of this

subkingdom, and it is among these that we encounter amazing displays of the "living light." The most brilliant exhibition of phosphorescence that I have seen was caused by immense numbers of ctenophores in Bahia Honda, Cuba. The animals kept in a compact body and produced a maze of intertwining circles of vivid light. These animals have so-called "eye-spots" and seem to be able to distinguish light. The phosphorescence may serve to keep them together, and thus effect the same end as "directive coloration" among vertebrates and insects.

It is worth noting that blind species of groups normally possessed of eyes are seldom if ever phosphorescent, a fact that seems further to enforce the idea that phosphorescence is used in connection with the power of vision, and probably serves as an aid thereto.

Although Noctiluca and other allied phosphorescent Protozoa are more properly pelagic than deep-sea forms, they may occur at considerable depths, and thus come within the province of this discussion. These differ from the organisms hitherto mentioned in that they have no recognized organs of sight, and, further, in their extreme simplicity of organization. Like most if not all Protozoa, they occur in enormous swarms and have some means of keeping together, as is necessary in the case of all forms that conjugate as a preliminary to reproduction, as do the ones under discussion. They are propelled by flagella and appear to control their own movements. At first thought one is at a loss to explain the phosphorescence of these eyeless free-swimming forms, but a little reflection will show a probable explanation. Although eyeless, many Protozoa have been proved to be sensitive to light, both natural and artificial. Any one who has worked with these lowly forms has noticed that each species has a preference for either the light or the dark side of the jar in which it is confined. Indeed it is practically certain that sensibility to light is a fundamental property of simple protoplasm. This being true, it is easy to conceive of the phosphorescence of Noctiluca and its allies as *directive* in function, thus aiding them in finding each other for the purpose of conjugation and the perpetuation of their kind.

This same explanation may be applied to many of the phos-

phorescent medusæ. In the subtropical Atlantic hundreds of square miles of the surface are thickly strewn with a medusa, *Linerges mercurius*, which glows like a living coal at night. This species has eight marginal sense-bodies, and the phosphorescence may well serve as a directive contrivance, aiding in the perpetuation of the species.

In general, it may be said that the phosphorescent powers possessed by free-swimming deep-sea forms can be accounted for in very much the same manner as their coloration, and serve much the same purposes as protective, aggressive, alluring, and directive colorations.

We now come to a consideration of the uses of phosphorescent powers in the second class of animals indicated at the beginning of this paper, namely, the *fixed forms*.

Most of the phosphorescent organisms in this group belong to the subkingdom Cœlenterata. Among the Actinozoa the Pennatulidæ are mentioned by several writers as being especially brilliant in their flashes of light. The gorgonians are also often phosphorescent, and Agassiz says: "Species living beyond 100 fathoms may dwell in total darkness, and be illuminated at times merely by the movements of abyssal fishes through the forests of phosphorescent alcyonarians."

Many authors have noted the light-emitting powers of numerous hydroids. These occur in great quantities over certain areas of the sea bottom, and must add considerably to the sum total of deep-sea light.

It may, I think, be said that in general the fixed marine forms are not behind their free-swimming allies in either the quality or quantity of their light-producing powers.

The question now before us is: "Of what use is this power to its fixed and sightless possessors?"

Perhaps the most generally accepted opinion is that suggested by Verrill, who regards the phosphorescence as *protective* in function. Most Cœlenterata, he argues, are possessed of nematocysts. Fishes are known in some instances to eat the polyps of colonial forms, and they might come to associate the phosphorescence with the nettling cells, and thereafter avoid those forms showing the danger signal.

It is somewhat unfortunate for this argument that few if any of the fixed Cœlenterata that are remarkable for their phosphorescence possess nematocysts that are likely to be regarded by a hungry fish as at all formidable. The Gorgonidæ, Antipathidæ, Alcyonidæ, and Pennatulidæ, all notably phosphorescent, are almost if not quite destitute of nematocysts. As for the Hydroida, there is only one known species, so far as I can learn, whose nematocysts can be felt at all by the human skin. Millepora, if it be a hydroid, is of course another exception.

Neither is it likely that the phosphorescence of these fixed forms serves the same purpose as attractive coloration. Although the Cœlenterata are, in general, bisexual, the spermatozoa are shed into the water to find their way as best they can to the female element in other colonies. So far as I know, the colonies of both sexes are phosphorescent, but the light, in the hydroids at least, seems to be mainly confined to the polyps, or nonsexual "persons," excepting in those forms that produce medusæ.

Having shown that the phosphorescence of fixed forms cannot be regarded as protective, and that it does not appear to be for the purpose of attracting or guiding the sexes in coming together, we turn to a third and more promising explanation.

The food of the fixed Cœlenterata consists mainly of either Crustacea of the smaller sorts, their embryos, the Protozoa, or the unicellular plants, such as diatoms.

Most of the minute Crustacea have effective eyes, and it has been repeatedly demonstrated that they are attracted by light, both artificial and natural. Crustacean embryos usually have eyes that are very large in proportion. In many cases these, too, are attracted by light. Although I know of no direct experiments being made with phosphorescent light, it is reasonable to suppose that it would affect them in a like manner, although probably in a less degree. If this is true, the phosphorescent powers of the fixed Cœlenterata would cause the small crustaceans, and more surely their embryos, to congregate near the illuminated areas, and thus be captured. This is on the same principle that many fishes, birds, and even mammals

are secured by what is known as "fire hunting." In this same way the entomologist reaps a harvest by the aid of the electric light. The process would be analogous, perhaps, to what is known as "alluring coloration," and its function in decoying prey. The phosphorescence would thus be of direct utility to the fixed cœlenterates in securing crustacean food.

We may, I think, still further extend the application of this idea so as to include the attraction of Protozoa and even diatoms. As already remarked, both of these groups of organisms contain many species that are strongly attracted by light, which appears to act as a direct stimulus to both unicellular animals and plants by virtue of its well-known effect on protoplasm itself.

We thus see that all of the more important organisms upon which fixed cœlenterates feed are likely to be attracted by light, and it is reasonable to assume that phosphorescent light affects them in this manner.

This, then, is the hypothetical explanation by which we may explain the possession of phosphorescent light by so many fixed Cœlenterata on the old Darwinian principle of direct benefit to its possessors, the benefit being the aid rendered in securing food.

A NEW HYDROID FROM LONG ISLAND SOUND.

CHAS. P. SIGERFOOS.

DURING the summer of 1898, while enjoying the facilities of the seaside laboratory of the Brooklyn Institute of Arts and Sciences at Coldspring Harbor, Long Island, the writer found a hydroid which possesses special interest on account of the peculiar features which characterize it. The specimens collected last year were obtained on a single day, and a description has been delayed that new data might be added through wider observations during the present summer.

Early in August, 1898, while exploring the east end of Lloyd's Harbor, a part of Huntington Bay, small flocculent masses of different colors were observed in considerable numbers on the eelgrass which forms a dense growth on the bottom. Again this year the same locality was visited several times from July 8 to August 16, and each time numerous specimens were collected. The small cove in which they were found is a few acres in extent and well sheltered from high winds, so that the surface is usually smooth. During high tide the water may be ten feet deep, but at low tide the grass forms more or less of a mat upon the bottom.

Casually examined, the flocculent masses appeared quite similar to the well-known hydroid Hydractinia, found abundantly on our Atlantic coast, including Long Island Sound. But examined more carefully, it was found that the inhabitants of the shells on which the hydroid lives are living snails (*Ilyanassa obsoleta*), and not the hermit crabs with which Hydractinia is most frequently associated. Also, that the make-up of the colony as a whole and the character of the individuals are different from those of Hydractinia.

A general view of a female colony, natural size, is shown in Fig. 1, in which the snail is represented as moving slowly over a blade of eelgrass. Though the colonies are rather small, the

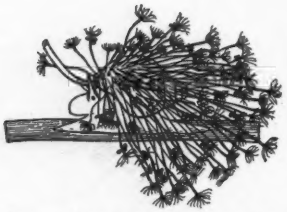


FIG. 1.—Colony of *Stylactis Hooperii* on the shell of a living *Ilyanassa obsoleta*, which is represented as crawling over a blade of eelgrass. Natural size.

larger ones may contain as many as two or three hundred individuals. In a figure it is not feasible to represent more than a third of those found in a dense colony.

The colony includes two, and only two, kinds of individuals, the nutritive and the reproductive. The protective spiral zoöids found in Hydractinia are not present.

A small part of a colony, enlarged six diameters, is represented in Fig. 2. The hydranths or individuals are sessile, arising directly from the complicated system of tubes, the hydrorhiza, which closely invest the surface of the snail shell. These tubes (Figs. 2 and 3) form a network lying in a general way in one plane. From this network arise the hydranths and also a few small spines (sp., Figs. 2 and 3), which seem to be homologous with those found in such forms as Hydractinia and Podocoryne. The tubes differ from those of these two genera, however, in not having the continuous layer of flesh (the cœnosarc) which covers the superficial surface of

FIG. 2.—Part of a colony magnified six diameters. (1) large nutritive hydranth fully expanded; (2) same slightly contracted; (3) same fully contracted; (4) large reproductive hydranth fully expanded; (5) smaller reproductive hydranth, slightly contracted; *Hr.*, tubes of hydrorhiza; *sp.*, spines.

the hydrorhiza in Hydractinia and Podocoryne. But there is a thick cushion of diatoms, simple algæ, and other detritus which forms a mat over the surface of the shell and around the attached ends of the hydranths. It seems to collect because the colonies are not tumbled about as in Hydractinia. The spines do not project beyond the surface of the mat and seem not to be efficient structures in protecting the colony. They are probably vestigial.

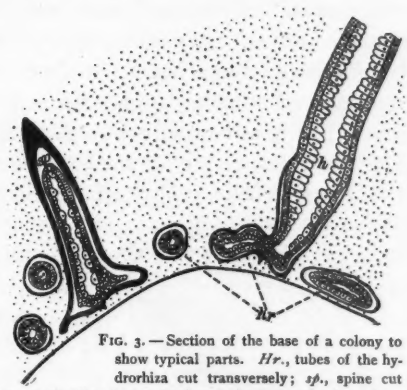


FIG. 3. — Section of the base of a colony to show typical parts. *Hr.*, tubes of the hydrorhiza cut transversely; *sp.*, spine cut longitudinally; *h.*, proximal part of a hydranth arising from a tube of the hydrorhiza. The dotted area represents the diatoms and other detritus which surround the base of the hydranths. × 30.

As stated above, there are but two kinds of hydranths, the nutritive and reproductive. They are present in approximately equal numbers, and uniformly distributed among each other throughout the colony. Both were found in all stages of development. I have no evidence that either ever becomes transformed into the other. As in other hydroids, the sexes are separate, the male colonies apparently being much more numerous than the female. Of eighty-three colonies observed at different times, sixty were male and but twenty-three female.

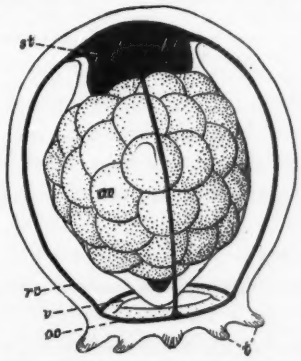


FIG. 4. — Recently liberated female medusa, before extrusion of the eggs. *C.c.*, circular canal; *r.c.*, radial canal; *st.*, stomach; *t.*, tentacles; *v.*, velum; *ov.*, ova. × 50.

The nutritive hydranths (Fig. 2, (1)–(3)), when fully extended, are perhaps more elongate than those of any other marine hydroid heretofore observed. Each arises directly from the tubes of the hydrorhiza, and at the base is covered for a very

short distance only by a continuation of the chitinous perisarc. Each hydranth is essentially a very long tube, consisting of two layers, the ectoderm and entoderm. It is of uniform diameter below, but somewhat swollen at the distal end below the circlet of tentacles. The latter are arranged in a single verticel and number from fifteen to thirty, or even thirty-five. There are usually between eighteen and twenty-five. The tentacles are solid, the entodermal core consisting of a single row of cells. Throughout the length there are stinging cells, but they are more abundant near the tips. The same applies to the hydranth body, in which the stinging cells are much more abundant around the hypostome. The tentacles are frequently bifid.

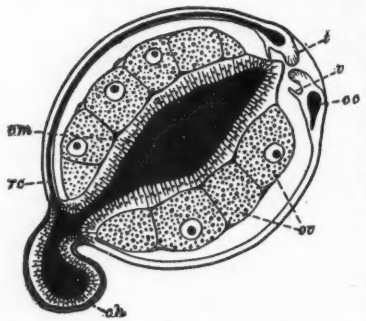


FIG. 5. — Longitudinal section of nearly mature female gonophore. *C.c.*, circular canal; *r.c.*, radial canal; *t.*, tentacle; *v.*, velum; *c.m.*, digestive cavity of gonophore, and *c.h.*, of the hydranth; *ov.*, ova. × 50.

In their general features the reproductive hydranths (Fig. 2, (4) and (5)) are quite similar to the nutritive, the differences in the former being the somewhat smaller size, the smaller numbers of tentacles, and the presence of a variable number of buds which develop into medusæ. In fully developed individuals the number of tentacles varies from six to fifteen, the usual number being eight to twelve. Like those of the nutritive hydranths, they are filiform, of uniform diameter, and arranged in a single circle. The reproductive buds vary in number from one to seven, the usual number being four or five. The presence of buds in various degrees of development in all colonies collected from July 8 to August 16, indicates that the breeding season extends at least through July and August. It may be that it begins earlier and ends later. When mature, the buds are set free from time to time as free-swimming medusæ. Though chiefly concerned with reproduction, these hydranths are also capable of taking food, at least sometimes.

The medusa (Fig. 4) represents a stage in organization that occurs but seldom among the Hydromedusæ. When it is liberated the sexual products, borne on the very large manubrium, are fully matured, so that the medusa after its liberation does not nourish and develop the former, but only distributes them. This done, the medusa dies, after its free-swimming life of a few hours. Its organization is quite simple, a condition to be expected both in connection with the recent liberation and its transitory existence. So far as could be determined, from the very rudimentary condition or absence of the characters usually employed in classification, it belongs most nearly to Haeckel's Dysmorphosa type, in which the mouth parts and tentacles are simple, the latter eight in number.

Though the medusa has most of its structures degenerate, it is still distinctly a medusa. As seen in side view (Fig. 4), it is somewhat higher than wide, its vertical diameter being about 1 mm. Into the cavity of the bell hangs the very large manubrium, which is gorged with sexual cells. There is no mouth opening and no lips nor tentacles around the mouth region. From the upper part of the stomach pass the four radial canals which connect with the circular canal at the edge of the bell. From the outer edge of the umbrella project eight equal rudimentary tentacles, four paradial and four interradial. They bear numerous stinging cells, but eye-spots seem to be absent. From the inner edge of the bell projects the narrow velum. Lining the subumbrella there is a well-developed layer of muscle fibres, and though degenerate in most ways, the medusa swims actively during the few hours of its free life.

In my specimens the medusæ were liberated in the evening, soon after dark, and though it would not be safe to conclude that this always takes place, I am inclined to think that it does. In a species of another hydroid (Pennaria) which the writer observed in Jamaica, and in which the medusæ likewise lead a free life of but a few hours, the latter are liberated within an hour after dark, at almost exactly the same time from day to day. I think the same may be found to hold for the form here described.

The condition of the medusa in this species, when liberated, is of further interest from a systematic standpoint. Allman, in his monograph on the *Tubularian Hydroids*, made the organization of the medusa a diagnostic character for the separation of families within the group. His Hydractinidæ and Podocorynidæ differ only in details from each other, except that in the former the medusoid buds remain in a rudimentary condition in the form of sporosacs, while in the latter the medusæ are liberated and lead a free-swimming life of considerable duration. In the form here described we have an exactly intermediate condition. Should the characters used by Allman stand, a new family would have to be established to include the species here described. But it seems that they are too narrow at this point, and that this species should be included under his family Bimeridæ. If so, it becomes a species of Stylactis. For it I propose the name *S. Hooperii*, after Professor Franklin W. Hooper, the secretary of the Brooklyn Institute, who has contributed so much to the success of the laboratory at Coldspring Harbor.

The hydroid here described is one of the most beautiful and graceful that has been observed. The delicacy of the individuals seems correlated with the protection afforded the colony through association with the Ilyanassa and its habitat in a locality free from high winds. Though the color of most of the colonies is whitish, many are of a pink or olive green or yellowish tint. Its only American ally so far observed is *S. arge*, found in the Chesapeake Bay and described by S. F. Clarke. It differs from the latter, however, which is found attached to the stems of Zostera, in which the eggs develop into planulæ before being liberated; and in which the terminal portion of the hydranths are described as breaking off to establish new colonies.

Diagnosis of the Species S. Hooperii. — Hydrocaulus absent; hydrorhiza a network of tubes lying in one plane, from which arise small, simple spines and the sessile hydranths, which are of two kinds, nutritive and reproductive; they are similar to each other and extremely elongate. The nutritive hydranths may attain a length of two to two and a half centimeters and

bear usually about twenty tentacles, arranged in a single circle. The reproductive hydranths are slightly smaller and bear usually six to ten tentacles and four or five reproductive buds. Medusa becoming free, though degenerate, the sexual products mature when the medusa is liberated. Medusa with four radial canals; eight equal rudimentary tentacles; mouth opening and mouth parts absent; velum developed.

UNIVERSITY OF MINNESOTA,
August 21, 1899.

A BALLOON-MAKING FLY.

J. M. ALDRICH AND L. A. TURLEY.

On June 16 of this year, while passing along a country road near Moscow, Idaho, our attention was attracted by some bright white objects moving to and fro in the air at an elevation of eight or ten feet. A second look seemed to indicate that these objects were connected with small insects. On capturing the insects they were found to be males of a species of Empis, each carrying between its hind feet a peculiar structure which is referred to in the title as a balloon. This is of elliptical shape, about 7 mm. long (nearly twice as long as the fly), hollow, and composed entirely of a single layer of minute bubbles, nearly uniform in size, arranged in regular circles concentric with the axis of the structure. The beautiful, glistening whiteness of the object when the sun shines upon it makes it very conspicuous. The bubbles were slightly viscid, and in nearly every case there was a small fly pressed into the front end of the balloon, apparently as food for the Empis, as the attached species were partly Chironomus and partly Oscinids, and other Acalyptrate Muscids. In all cases they were dead.

The balloon appears to be made while the insect is flying in the air. Those flying highest had the smallest balloons. The bubbles are probably produced by some modification of the anal organs, as in Aphrophora and other leaf-hoppers, but no positive observations on this point could be made. It is possible that the captured fly serves as a nucleus to begin the balloon on. One case of a captured fly but no balloon was observed. After commencing, it is probable that the rest of the structure is made by revolving the completed part between the hind legs and adding more bubbles somewhat spirally. The posterior end of the balloon is left more or less open.

The balloons were so light and sticky that they could not be preserved with any success. The first lot obtained were placed

in a corked vial, and had all collapsed by the next day. The second lot were placed in an open vial, which was left on the ground for a little while, and the ants carried off all the specimens. A third lot in open vials retained their shape in some degree, but were all more or less shriveled. One placed in alcohol immediately dissolved.

FIG. 1.

The purpose of this structure is to attract the female. When numerous males were flying up and down the road, it happened several times that a female was seen to approach them from some choke-cherry blossoms near by. The males immediately gathered in her path, and she with little hesitation selected for a mate the one with the largest balloon, taking a position *upon his back*. After copulation had begun, the pair would settle down towards the ground, select a quiet spot, and the female would alight by placing her front legs across a horizontal grass blade, her head resting against the blade so as to brace the body in position. Here she would continue to hold the male beneath her for a little time, until the process was finished. The male, meanwhile, would be rolling the balloon about in a variety of positions, juggling with it, one might almost say. After the male and female parted company, the male immediately dropped the balloon upon the ground, and it was greedily seized by ants.

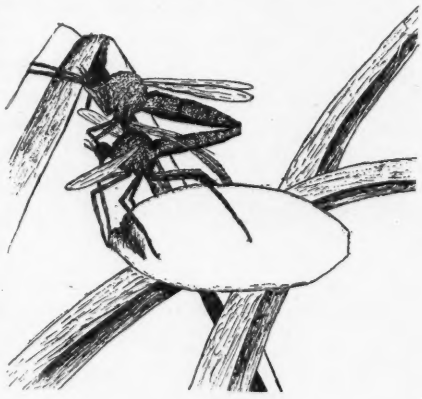


FIG. 2.

Of the accompanying sketches, Fig. 1 shows the position of

the balloon when the male is flying. It is frequently carried farther back, apparently by the hind legs alone. Fig. 2 shows the position assumed in copulation, the male underneath rolling the balloon.

No illustration could properly show the beauty of the balloon, still less could anything worthy of the subject be made from the shriveled and flattened specimens that now remain in our

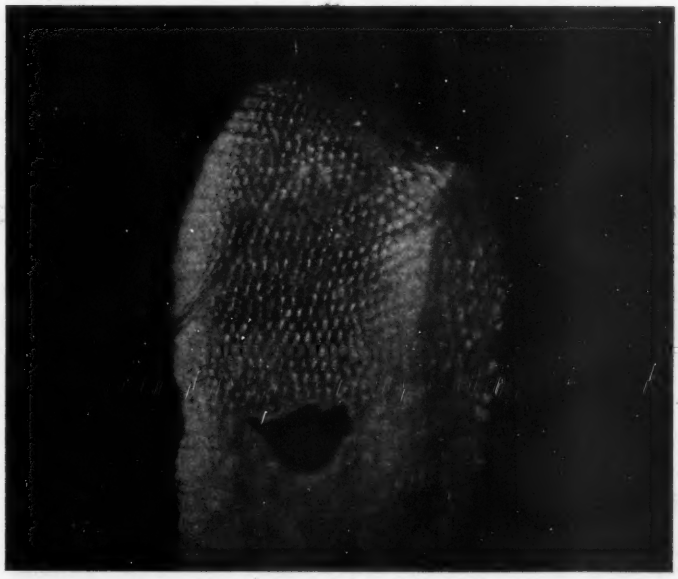


FIG 3.

possession. The half-tone (Fig. 3) serves only to show the way it is formed of bubbles.

The only published observations at all comparable with these are on the European species of Hilara, a genus of Empidæ closely related to Empis, and especially on *Hilara sartor* Becker. Several entomologists have published articles on the species, and there has been considerable difference of opinion as to the nature and purpose of the structure carried by the fly, as well as the method of carrying it. Professor Mik, in the

Wiener Entomologische Zeitung, Vol. XIII, pp. 271–284, and Pl. II, Figs. 8–13, gives an exhaustive discussion of the whole subject, with citations of the other authors and extracts from their papers. According to Mik, who had abundant opportunities for observation, the male produces a real web which is borne by the hind feet and serves to assist the fly in the somewhat peculiar gyrations of its flight. The different nature of the structure makes it unnecessary to go into further particulars here.

The species to which our observations pertain was sent to Professor Wheeler, of Chicago, who has been studying the family for several years, and identified by him as *Empis poplitea* Loew, "or a closely related species."

The use of the term "balloon" should not be taken to imply that the structure described is lighter than air.

HAVE WE MORE THAN ONE SPECIES OF BLISSUS IN NORTH AMERICA?

F. M. WEBSTER.

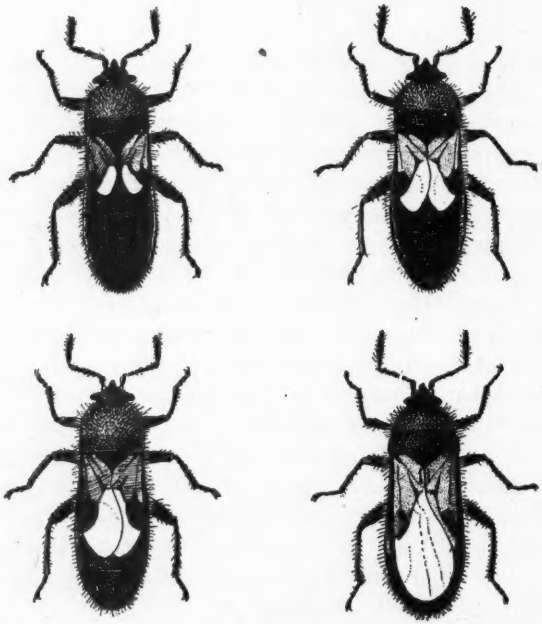
It is a fact, well known among entomologists, that the original description of *Blissus leucopterus* Say was drawn up from a single specimen taken on the eastern shore of Virginia. This was, therefore, probably a macropterous individual belonging to the maritime race that inhabited the Atlantic coast. It was not until long after that the brachypterous form was discovered, and attention was first directed thereto by Dr. Asa Fitch in his second report on the insects of the state of New York, and it was figured by Riley in *The American Entomologist*, Vol. I, p. 174, May, 1869, Dr. Fitch designating it as variety *apterus*. The infrequency with which this brachypterous form has been observed in the past is due to its almost universally secluded habits, as will be explained later.

Say's description, in which he named the insect *Lygæus leucopterus*, appeared in 1831, and in 1850 Dr. William Le Baron, afterwards state entomologist of Illinois, having overlooked Say's description, again described the species as *Rhyparochromus devastator*, the description, this time, having been based on material secured in Illinois, where the species was at that time excessively abundant.

According to Professor Cockerell there appeared in 1893, in *Ann. Soc. Ent. Belg.*, Vol. XXXVIII, two additional descriptions, namely, *B. hirtus*, from North America, and *B. pulchellus*, from Central and South America, both by Montandon. As the specimens recorded from the islands of Granada and St. Vincent by Uhler, and which were collected by Mr. H. H. Smith, are said to be of larger size and more variable than *leucopterus* and with fully developed wings, it would seem that Professor Cockerell may be right in thinking that these were, perhaps, Montandon's *pulchellus*. Just what his *hirtus* may

be I am unable to conjecture. *Leucopterus*, or what has been universally conceded as that species, has been collected in Panama and other localities in Central America; but as the collecting was probably somewhat superficial, we have very likely much to learn regarding the species in that country.

Along the Atlantic coast from central Florida to Nova Scotia and inland to northern Indiana, Ohio, and Ontario, we



Figures illustrating variation in wings of Atlantic maritime race of *Blissus leucopterus*.

have what I have here termed a maritime race, composed of individuals of both sexes whose wings may be nearly or quite aborted, or varying between these and the completely winged, and which freely interbreed, both with each other and the inland race, among whom brachypterous individuals are not usually found.

On the Pacific coast, in the vicinity of San Francisco, a similar race occurs, including also brachypterous individuals.

Whether this is in all respects similar to the Atlantic coast race or not is yet to be determined. This last is as yet known only in California, but it is not unlikely that it will in future be found to extend along the entire coast from California southward to Panama. The similar race that occurs along the Atlantic is at present known, to the southward, only to the Atlantic coast of Florida, not having yet been observed, so far as known, anywhere along the Gulf of Mexico. It must be stated, however, that except in the closest proximity to the sea, where Mr. Schwarz has found that it lives on the upper portion of its food plant, these brachypterous individuals are found only about the roots of their food plants, usually slightly below the surface of the soil, so that their detection is not an easy matter, unless one searches carefully for them. It must, therefore, be said that we really do not know whether this race occurs along the Gulf coast or not.

A somewhat extended study of this maritime race in Ohio has disclosed some interesting differences between the habits of this and the exclusively macropterous race inhabiting the interior of the country. These differences, together with minor anatomical ones, have been thought by some entomologists to be sufficient grounds for separating Say's *leucopterus* from Le Baron's *devastator* and making a separate species of each. I will give these differences between the two, as I have found them in Ohio, taking up first the maritime race.

The Atlantic maritime race is composed of brachypterous and macropterous individuals, the relative number of each being, so far as observed, somewhat variable. As the macropterous individuals may take wing and abandon in spring the fields occupied by the two forms jointly, it is obviously impossible to make any estimates of their relative numbers except during hibernation or immediately after the young have developed to adults. I have not found that the macropterous individuals part company with the brachypterous individuals with anything like the celerity or entirety that has been observed in the case of the European species, *Blissus doræ*, as witnessed by Professor Sajö. In our species both forms may be found together at all times, but where a field of corn or wheat adjoins a meadow, the

macropterous individuals only will be found among the grain, while the brachypterous ones will as uniformly remain in the timothy meadow. Among this race I have never been able to detect the slightest indication of a second brood. It is apparently much less affected by wet weather during the breeding season. This has also been observed by the late Dr. Lintner in New York. In the meadows the attack of Sporotrichium is much less marked, but in the insectary this has not proved true, thus indicating that the difference may be one of environment rather than in the resistant power of the insect itself. In the *Report of the U. S. Commissioner of Agriculture* for 1887, Pl. I, Figs. 1–8, the brachypterous maritime form is shown as quite different both in form and color from those found inland. Mr. Schwarz has since stated in *Insect Life*, Vol. VII, p. 420, that this difference in color was unreal, while Dr. Howard wrote me last summer that figures drawn from the material sent him from Ohio represented the maritime individuals much better than Fig. 8, in the plate, in the Commissioner's Report above referred to; so that it would seem that the striking differences there indicated do not exist in fact. Mr. Van Duzee has called attention to a possible difference between specimens from New York and Kansas, the former seeming to be more hairy and robust than the latter, but he writes me that this may have been due more to the season than to the locality.

The inland race has rarely been observed to depredate on timothy, and never in the manner followed by the Atlantic maritime race. It is two-brooded, and all members of the race macropterous, but in confinement freely interbreeds with brachypterous individuals of the maritime race. In Ohio the latter occupies the north and northeastern portion of the state, while the inland race covers the western and southern portion. The only exception to this that I have observed is the finding of two brachypterous individuals in hibernation in southwestern Ohio, not far from the Ohio River. The maritime race might have been brought into southwestern Ohio, either by being washed into the upper Ohio River in the northeastern part of the state and, as with some other species, carried down stream

and deposited in the fields along the river, or, possibly, by pushing through the Allegheny Mountains of Virginia and West Virginia from the Atlantic coast, by way of the valley of the Big Kenawaha River. Whether or not this was actually the case can only be determined by a study of the insect fauna of the Big Kenawaha valley. Mr. C. L. Marlatt, who has been making a study of the genital organs of both the maritime and inland races, writes me that he has not been able to find any material difference between them.

The Pacific coast race has not been carefully studied, or the area over which brachypterous individuals occur. It would indeed be interesting to know whether two races from the same original stock would develop alike, the one on the Atlantic coast and the other on the Pacific, as it would have a bearing on the oft-repeated question as to whether the same species can be evolved in two widely separated localities.

In summing up the testimony, then, the question put in my title can be answered only by saying that, with our present knowledge, there appear to be no differences between our known forms of Blissus, in North America, that cannot be accounted for by environmental influences. In this paper I have given them, tentatively, the position of separate races, but even that term may in future be found inapplicable. It is very significant that one cannot take up the study of an insect so common and well known as the chinch bug without encountering so many and such wide breaks in our knowledge of the species.

SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

J. S. KINGSLEY.

IV. Astacoid and Thalassinoid Crustacea.

The following synopsis, together with the one given in this journal for September, includes the whole macrurous fauna of North America north of the southern boundary of the United States and within the hundred-fathom line. Geographical distribution is indicated, as before, by full-faced letters : **N**, **M**, **S**, indicating the northern, middle, and southern Atlantic coast; **A**, **P**, **D**, corresponding divisions of the Pacific coast.

The Astacoid forms include those forms familiarly known as lobsters and crayfishes, as well as some others for which no common name is in general use. The crayfishes (genera Astacus and Cambarus) are inhabitants of fresh water; the others are marine. Most important of these is the lobster, once very abundant from New York northward, but now becoming much more rare, owing to overfishing and to disregard of the law prohibiting the taking of immature and egg-bearing animals.

The crayfish are fresh-water forms, occurring sparingly in New England and the southern British Provinces, and far more abundantly in the rest of our territory, where every stream and pond has its representatives. The discrimination of the species is not easy, and for the present we give no key to the fifty-one species described from our limits. The difficulties which surround the systematic arrangement of these forms can be seen from the fact that the late William Stimpson, our most accurate student of the Crustacea, would not touch the crayfish, remarking that either we had only one species of Cambarus in our country, or each mud puddle had its own species.

In the southern waters and on our Pacific coast the lobster

is replaced by the Palinurids or spring lobsters, and by the flattened Scyllarids. These groups are frequently united by European carcinologists under the name Loricata. They are extremely interesting, on account of the peculiar leaf-like larvæ (Phyllosoma) which hatch from the eggs. In these the body is scarcely thicker than a sheet of this paper, but it may be two or three inches in length and half as broad.

The Thalassinids are marine burrowing forms, living in the sand and mud and frequently showing the effects of this life in the very soft and membranous integument, the pincers alone being hardened in some of these Crustacea.

The most important papers relating to the description of our American species are:—

MILNE-EDWARDS. Histoire Naturelle des Crustacés. Tome ii. 1837.
DANA. Crustacea of the United States Exploring Expedition. 1852.
STIMPSON. Crustacea of Pacific Coast. *Journ. Boston Soc. Nat. Hist.* Vol. vi. 1857.
HAGEN. Monograph of the North American Astacidæ. *Mem. Mus. Comp. Zoöl.* Vol. iii. 1870.
SMITH. Invertebrates of Vineyard Sound. *Rep. U. S. Fish Commission for 1871–72.*
SMITH. Preliminary Notice of Crustacea [etc.]. *Proc. U. S. Nat. Mus.* Vol. iii. 1881.
RANDALL. Catalogue of Crustacea [etc.]. *Journ. Acad. Nat. Sci. Philadelphia.* Vol. viii. 1839.
STIMPSON. Notes on North American Crustacea. *Annals N. Y. Lyc. Nat. Hist.* Vol. x. 1871.
GIBBES. *Proc. Am. Assoc. Adv. Sci.* Vol. iii, pp. 192–195. 1851.
KINGSLEY. *Bull. Essex Inst.* Vol. xxvii, p. 95. 1897. Vol. xiv, p. 131.
FAXON. A Revision of the Astacidæ. *Bull. Mus. Comp. Zoöl.* Vol. x. 1885.

KEY TO ASTACOID AND THALASSINOID CRUSTACEA OF THE UNITED STATES.

1. Macrura (see *Am. Nat.*, vol. xxxiii, p. 708) 2
2. Carapax with two longitudinal sutures; cervical suture frequently present; antennal scale small or wanting . . Thalassinoidea 12
2. Carapax without longitudinal sutures; cervical suture frequently present; antennal scale small or obsolete . . . Astacoidea 3
2. Carapax without sutures; antennal scale large Caridea (see p. 713).
3. Antennal scale usually present; anterior feet chelate; body sub-cylindrical; abdomen large . . . . . Astacidæ 4

3. Antennal scale absent, anterior feet monodactyl 8
4. Hand of chelipeds large, broad, margins rounded, surface convex Astacinæ 5
4. Hands of chelipeds prismatic, sides nearly straight (Nephropsinæ) 7
5. Last thoracic segment not mobile; species marine . *Homarus* 17
5. Last thoracic segment free from the rest; fresh water . . 6
6. Branchiæ 17; species from the Atlantic water shed . *Cambarus* 22
6. Branchiæ 18; species from the Pacific slope . . *Astacus* 18
7. Antennal scale absent; chelipeds densely pubescent . *Nephropsis* 23
7. Antennal scale present; chelipeds naked and carinate *Nephrops* 24
8. Body strongly depressed, lateral portions of carapax thin, margins inflexed; antennæ lamellate . . . . . Scyllaridæ 10
8. Body and base of antennæ sub-cylindrical . . . Palinuridæ 9
9. Antennæ nearly touching at base; antennular flagella and rostrum short . . . . . *Palinurus* 26
9. Antennæ remote; antennular flagella long; rostrum absent *Panulirus* 25
10. Carapax elongate or sub-quadrate 11
10. Carapax transverse, sides incised.[1]
11. Rostrum well developed; antennæ touching at the base; exopodite of external maxilliped with flagellum . . . . *Scyllarus* 27
11. Rostrum very short; antennæ remote; no flagellum to exopodite of external maxillipeds . . . . . *Arctus* 28
12. Branchiæ thoracic; external maxillipeds pediform; caudal fin broad Gebidæ[2] 13
12. Branchiæ thoracic; external maxillipeds expanded operculiform; caudal fin broad . . . . . Callianassidæ 16
13. Second pair of feet monodactyle, no antennal scale . . *Gebia* 34
13. Second pair of feet didactyle; a small antennal scale . . 14
14. Eyes normally pigmented 15
14. Eyes destitute of pigment and cornea . . . *Calocaris* 37
15. Hand of chelipeds regularly chelate . . . . *Axius* 35
15. Hand sub-chelate, the pollex folding on the palm . *Naushonia* 36
16. Eyes sub-lamellate; antennular flagella longer than preceding joints; second pair of feet chelate . . . . . *Callianassa* 29
16. Eyes cylindrical; antennular flagella rather shorter than peduncle; second pair of feet chelate . . . . . *Callichirus* 33

[1] *Ibacus parræ* (West Indies) and *Evibacus princeps* (Lower California) may occur within our limits.

[2] By the characters of the maxillipeds the genus Glypturus would belong in the family Gebidæ, but Stimpson gives no characters of second pair of feet or of presence or absence of an antennal scale. He compares it with *Callianassa grandimana*. *G. acanthochirus* comes from Florida. The writer has seen no specimens.

SYNOPSIS OF SPECIES.

Group ASTACOIDEA.

Family ASTACIDÆ. Sternum narrow; abdomen slightly narrower than cephalothorax.

Genus *Homarus* Milne-Edwards. Lobsters. Rostrum slender, conical, with a few teeth on sides.

17. . . . . *H. americanus* Milne-Edwards **N, M**

Genus *Astacus* (Fabr.) Milne-Edwards. First segment of abdomen with appendages. Species confined to Eurasia and the Pacific slope of America.

18. Margins of rostrum denticulate 19
18. Margins of rostrum not denticulate 20
19. Rostral acumen long; chela not barbate . *A. nigrescens* Stimpson
19. Rostral acumen short; chela barbate . . *A. gambeli* (Girard)
20. Rostrum short, with short acumen; postorbital ridge without posterior spine . . . . . *A. klamathensis* Stimpson
20. Rostrum long, with long acumen; postorbital ridge with posterior spine or tubercle 21
21. Posterior spine of postorbital ridge long; cardiac areola half as broad as long . . . . . *A. leniusculus* Dana
21. Posterior spine small or tubercular; areola one-third as broad as long *A. trowbridgii* Stimpson
22. Genus *Cambarus* Erichson. First segment of abdomen with appendages. Species confined to waters draining into the Atlantic. Fifty-one species and several varieties recognized by Faxon within our limits. Reference should be made to his monograph for identification.

Genus *Nephropsis* Wood Mason. Species from deep water.

23. Two pairs of lateral spines on rostrum . *N. aculeatus* Smith **M**

Genus *Nephrops* Leach.

24. . . . . *N. occidentalis* Randall[1]

Family PALINURIDÆ. Antennal base long, stout; sternum trigonal; none of the feet chelate. Tropical and temperate in our waters; animals of large size, familiarly known as spiny lobsters.

Genus *Panulirus* Gray.

25. No spine in median line of gastric region; posterior border of the lateral angles of abdominal segments with a single spine; basal joint of antennulæ very long . . . . *P. americanus* (Lam.) **S**
25. Gastric region with seven spines, the middle one largest, sulci of abdominal segments interrupted in middle, except on last segment *P. interruptus* (Randall) **P, D**

Besides, *P. guttatus* and *P. argus* may occur in Florida. They have not been reported from there.

[1] Described by Randall from "the west coast of North America." Probably was from the Hawaiian Islands. See *Bull. Essex Inst.*, vol. xiv, p. 131.

Genus *Palinurus* (Fabr.) Gray.

26. . . . . *P. longimanus* Milne-Edwards **S** (?)

Family SCYLLARIDÆ.

Genus *Scyllarus* Fabr. Branchiæ 21.

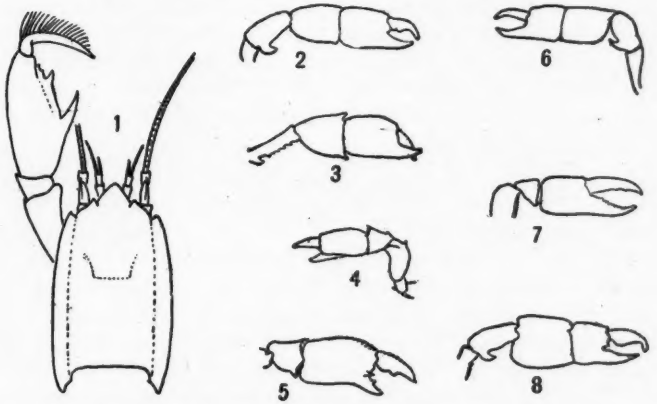
27. Gastric region without spines; posterior border of third abdominal segment regularly arcuate . . . *S. æquinoxialis* Fabr. **S**

27. Gastric region with bidentate projection; third abdominal segment with a strong knob . . . . . *S. nodifer* Stimpson **S**

Genus *Arctus* Dana. Branchiæ 19.

28. Antepenult segment of antenna with two teeth on external margin; sternal segments without conspicuous spines *A. americanus* Smith **S**

28. Antepenult segment of antenna with three teeth, sternal segments with conspicuous spines . . . . . *A. depressus* Smith **M**



Chelæ of Thalassinoid Crustacea.—(1) Naushonia crangonoides; (2) Callianassa longimana; (3) Callianassa gigas; (4) Gebia affinis; (5) Gebia pugettensis; (6) Callianassa stimpsoni; (7) Axius serratus; (8) Callianassa californiensis.

Group THALASSINOIDEA.

Family CALLIANASSIDÆ.

Genus *Callianassa* Leach. Chelipeds unequal in size, carapace smooth and glossy.

29. Meros of larger cheliped serrate below, palm nearly twice length of carpus . . . . . *C. grandimana* Gibbes **S**

29. Meros of larger cheliped with a strong proximal spine below . 30

30. Carpus and palm sub-equal 31

30. Carpus about twice the length of the palm 32

31. Meros short, tapering towards distal extremity; carpus without distal spines . . . . . *C. longimana* Stimpson **P**

31. Meros long, broadest at distal end; carpus with distal spines above and below . . . . . *C. gigas* Dana **P**

32. Height of carpus and palm sub-equal; no notch in palm below insertion of dactylus . . . . . *C. stimpsoni* Smith **M**

32. Carpus considerably higher than palm; a notch in palm just below articulation of dactylus . . . . . *C. californiensis* Dana **P**

Genus *Callichirus* Stimpson.

33. Body membranous; carpus and hand very long . *C. major* Say **M, S**

Family GEBIDÆ.

Genus *Gebia* Leach. Rostrum rough and hairy, chelipeds sub-equal.

34. Pollex with strong tooth on inner margin; carpus smooth above, with a strong distal spine . . . . . *G. pugettensis* Dana **P, D**

34. Pollex without tooth; carpus with a spine above, and five or six spines at tip . . . . . *G. affinis* Say **M, S**

Genus *Axius* Leach.

35. Abdomen broader than carapax; no teeth on dorsal carina of carapax *A. serratus* Stimpson **N, M**

35. Abdomen narrower than carapax; dorsal carina toothed *A. armatus* Smith **M**

Genus *Naushonia* Kingsley.

36. . . . . *N. crangonoides* Kingsley **M**

Genus *Calocaris* Bell. Hand slender, pollex elongate; rostrum triangular.

37. . . . . *C. macandreæ* Bell **N**

REVIEWS OF RECENT LITERATURE.

GENERAL BIOLOGY.

Action of Salt Solutions upon Eggs. — Few now underrate the value of physiological experimentation as an aid in the advance of pure science as well as a basis for practical arts, even though the results obtained may be but abnormal states of the organisms studied; it is a hopeful sign of the times that these methods are being so actively extended to the study of the lowest organisms and even to the sphinx-like mystery of the egg. An important venture in this direction is that of Professor T. H. Morgan,[1] who now adds a second paper to his first account of notable discoveries published three years ago.

This paper contains the results of arduous labor, and is illustrated by careful drawings. Only a few of the many important facts and inferences can be touched upon here.

The author found that sea-urchin eggs, whether fertilized or not, when placed a short time in sea water to which two per cent or less of sodium or magnesium chloride has been added, and then returned to common sea water, show inside clear spots which change position and number. When these eggs are sectioned and stained, the clear spots are represented by darkly stained regions and radiating lines — in fact "stars" comparable to those seen in karyokinesis. Some stars have central specks comparable to centrosomes.

If the eggs are not fertilized, they may nevertheless, when so treated, undergo a process of cleavage into many cells. The cleavage, however, is not like the normal, nor does it lead to the formation of larvæ, so far as known. Sections of such eggs show that the chromosomes are distributed through the egg, apparently by the action of the stars, and that the cleavage of the egg takes place about these chromosomes as centers.

In some other animals, notably a Nemertean and a Gephyrean, similar star-formations were produced by treating the unfertilized eggs with the same salt solutions.

It is thus possible to bring out stars and centrosomes similar to the normal ones, but in abnormal numbers and positions, by mere

[1] *Archiv f. Entwicklungsmechanik*, 1899, Bd. viii, pp. 448–536, Pls. VI–X.

excess of some of the salts common in sea water. Moreover, eggs that have not been fertilized may cleave in such changed sea water, and in this cleavage there are divisions and distributions of chromosomes with accompanying activities of centrosomes and of asters.

There is, of course, room for doubt and for difference of opinion as to the light shed by these abnormal processes upon the normal ones in the basic phenomena of fertilization and of cleavage. The author cites facts that show the power of the egg to cleave without the centrosome and the aster, and thinks the chromosome part of the nucleus the most influential part of each cell. As cleavage may take place without reference to asters, mechanical hypotheses of contractile bands or pushing rods seem to him unnecessary.

Centrosomes, he thinks, may be formed *de novo* from protoplasm outside the nucleus or within it, and may sometimes persist and in other cases be of short life. His results are to some extent iconoclastic, and he would depose the centrosome from its assumed rôle of hereditary monarch.

The author sees in these results of adding salts no direct mechanical phenomena, but only the reactions of living eggs when stimulated by changed environment. The egg becomes more a living thing than it seemed when we were ignorant of these possibilities.

Holding this standpoint, the author would do well to abandon his term "artificial stars," since it does not appear that these reactions to salts are more *artificial* than those produced by adding sperm, nor, in fact, than the reaction of a frog's leg when salt is placed upon it.

E. A. A.

History of the Natural Sciences. — The first volume of Dannemann's *Grundriss einer Geschichte der Naturwissenschaften*, which contains so admirable a series of selections from the works of the most distinguished natural scientists of the past, has been supplemented by a second volume,[1] in which the historical development of the natural sciences is dealt with. The subject-matter of this volume is largely astronomical, physical, and chemical; and the arrangement essentially chronological. While it is to be admitted that chemistry and physics are in a sense more fundamental than the biological sciences, and, therefore, deserve a certain degree of precedence in an historical account, it is to be regretted that so important

[1] Dannemann, F. *Grundriss einer Geschichte der Naturwissenschaften;* 2. Bd., *Die Entwicklung der Naturwissenschaften*, 435 pp., 76 illustrations. Leipzig, W. Engelmann. 1898.

and interesting a subject as the historical development of the biological sciences should have been passed over so lightly as in the present volume; for of its 425 pages only about 30 are devoted to the growth of biology, whereas in the first volume the biological selections cover some hundred of its 325 pages. Excepting for this disproportionateness, the second volume is fully equal to the first, and will afford profitable reading to those interested in the development of physical and chemical science. The work is well illustrated. G. H. P.

ANTHROPOLOGY.

The Races of Europe.[1] — In the preface to this important work Professor Ripley states that "it represents merely an honest effort to coördinate, illustrate, and interpret the vast mass of original material — product of years of patient investigation by observers in all parts of Europe — concerning a primary phase of human association: that of race or physical relationship." The book itself is the product of a vast amount of patient research, nor is the modest disclaimer of its author, that it contains nothing that is, strictly speaking, original, to be taken too literally. In some respects this volume justifies the statement that the Caucasic division of the human family "is in point of fact the most debatable in the whole range of anthropological studies"; on the other hand, it contributes more than any other single publication to refute the charge by bringing "this abundant store of raw material into some sort of orderly arrangement," and in its lucid exposition of the facts relating to the more difficult problems.

The work is based upon a course of lectures upon "physical geography and anthropology," subsequently published in *Appletons' Popular Science Monthly;* the notices thus called forth have sufficiently commended the plan and purpose of the work. The introductory chapter emphasizes the significance of geography from the standpoint of human interests; in fact, the interrelation of race and environment is the keynote of the whole volume. In his chapter upon language, nationality, and race the author maintains that the fundamental importance of ethnic conquests has not been commonly recognized by historians, and that it is not the direct relation of his-

[1] Ripley, W. Z. *The Races of Europe.* New York, D. Appleton & Co. 1899. 8vo, 624 pp.

torical movements to topographical features that furnishes the most fruitful field for research. Head-form, pigmentation, and stature are the three physical characters selected as sufficient criteria for the determination of the distribution of the races of Europe. But the greatest of these is head-form, or cephalic index; it is beyond the reach of artificial selection, wonderfully persistent within the group, and is a character observable with ease and accuracy. The color of hair and eyes is a much more complex factor, more subject to individual variation, also to variation with age; hair and eyes may be of the same color, or may vary independently of each other, and, finally, it is difficult to correct for the personal equation of different observers, so that "the precision of measurements upon the head is nowise attainable." Professor Ripley considers the evidence as yet insufficient to determine the cause of pigmentation. "It is not certain that the true cause lies in the modifying influences of climate alone." With some reserve, he accepts Livi's conclusion that blondness is due to unfavorable environment, yet inconsistently ascribes the blondness of the Teutonic peoples to that environment which has produced the most admirable physical type of all Europe; to be sure he regards artificial selection as a factor in the development of both the blondness and the tall stature of the Teutons, but Westermark's refutation of this hypothesis should be considered final. By the combination of these three traits, three races are formed — the Teutonic, Alpine, and Mediterranean. In an appendix an instructive comparison is drawn between this simple classification and that by Dr. Deniker, who distinguishes six main and four secondary "varieties." The Teutonic is regarded as the most characteristic and thus justifies the name — *Homo europæus* — bestowed upon it by Lapouge. The broad-headed type is termed "Alpine" rather than "Celtic," as "geographical names are least equivocal" and the "Celtic question" involves the discussion of philological and archæological data as well as somatological. The third "race" is long-headed, dark, and short in stature.

The succeeding seven chapters deal with these races as they exist within the various national and linguistic divisions of Europe. While the Jews do not belong to any of these European races, their numbers — six or seven millions — and peculiar racial solidarity render them of surpassing interest and importance to the anthropologist. Incidentally, Professor Ripley sounds a word of warning here: "This great Polish swamp of miserable human beings, terrific in its proportions, threatens to drain itself off into our country as well,

unless we restrict its ingress." The remarks upon the habits of life among the Jews that conduce toward longevity are suggestive. The Jews of New York, engaged in one of the most deadly occupations known, live nearly twice as long as their American neighbors, even those engaged in out-door labor. Our author's final conclusion is rather startling: "It is paradoxical, yet true, we affirm. The Jews are not a race, but only a people, after all." "No purity of descent is to be supposed for an instant." However, the table of observations on the cephalic index would seem to establish clearly the purity of the race and disprove his conclusion.

The political and anthropological problems centering in the Orient are set forth in two chapters dealing with the several racial groups found there, most of whom are not, strictly speaking, members of the three European races. Regarding the physical origin of the European races Professor Ripley concludes that as a whole they are intermediate between the Asiatics and Negroes; that the earliest population of Europe was dark and dolichocephalic, probably represented by the Mediterranean race of to-day; that the Teutonic race is a variety of the aboriginal, long-headed people which has acquired its distinctive tall stature and blondness from the effects of environment and artificial selection; that the Alpine type having Asiatic affinities overran Europe because of its superior culture, but that in time the Teutonic race reasserted itself and the constant tendency in recent times has been to push back the Alpine type into the "areas of isolation." From the data furnished by prehistoric archæology Professor Ripley summarizes as follows: During the later Stone Age an entirely indigenous culture was evolved in western and southern Europe; it was characterized by great technical advance in ornamentation, by construction of dolmens, by pottery-making, "and possibly even by a primitive system of writing." Throughout the Alpine highlands the higher Hallstatt culture, exhibiting Oriental affinities, appeared a thousand years or more before the Christian era. "This prehistoric civilization represents a transitional stage between bronze and iron." This culture roughly overlies the area occupied by the Alpine type. Progress is discernible, so that much of this culture was developed on the spot, that is, it was of European origin. The prehistoric Italian culture was due to the union of two cultures, the Hallstatt and one coming from the southeast, by sea, being distinctly Mediterranean. Throughout the prehistoric period the northwestern corner of Europe was characterized by backwardness in culture.

In the discussion of the subject of environment versus race, Professor Ripley asks if the student of social phenomena should acquaint himself with "the nature of the human stuff of which populations are compounded," or if these investigations are of merely academic interest. He points out some of the errors and even absurdities that result from the attempts of the "anthropo-sociologists" to classify social phenomena on an ethnic basis. "Contact of mind with mind is the real cause," and the appeal to the social geography of different countries at once discloses the contradictions that exist in the distribution of social phenomena amongst the different races. In the section upon social problems it is shown that the segregation of people into localized communities and of others into castes is a thing of the past. "Under the pressure of modern industrialism and democracy" both these forms are breaking down, and the geographical cleavage of locality and nationality as well are threatened. Economic and social attractions draw the country populations to the city. European cities are growing more rapidly in population as a result of this migration than are the urban centers of America. This is accompanied by a corresponding decrease in the population of the country districts. "The fact is that western Europe is being gradually transformed into a huge factory town." The inert sedentary character of the Alpine peoples prevents them from migrating in any great degree to the cities, so that the pressure of social forces tends to accentuate the mental differences now existing between Teutonic and Alpine types. But urban selection is more complex than the mere migration of a racial element toward the cities, and physiological and social rather than ethnic selection seems to be at work.

The closing chapter deals with the problems of acclimatization, and is of especial interest to every American citizen at this time. The questions that present themselves are, first, "can a single generation of European emigrants live? and, secondly, living, can they perpetuate their kind in the equatorial regions of the earth? Finally, if able permanently so to sustain themselves, will they still be able to preserve their peculiar European civilization in these lands?" After a brief consideration of the physiological peculiarities of race, Professor Ripley concludes that "the almost universal opinion seems to be that true colonization in the tropics by the white race is impossible." And again, "Authorities in favour of the view that complete acclimatization of Europeans in the tropics is impossible might be multiplied indefinitely."

This volume of over 600 pages is illustrated by a large number of portrait types and original maps that set a new standard for anthropological publications. It is accompanied by *A Selected Bibliography of the Anthropology and Ethnology of Europe*, published by the Trustees of the Boston Public Library. Nearly two thousand titles are included in the list.

FRANK RUSSELL.

Anthropological Notes. — In the July *Anthropologist* O. T. Mason presents a report of the discussion, or rather a summary of it by Professor McGee, by the Anthropological Society of Washington on the adoption of the term "Amerind" to designate the aboriginal tribes of the American hemisphere. The word is an arbitrary compound of the leading syllables of the phrase "American Indian." It is brief, euphonious, and lends itself readily to adjectival and adverbial terminations. The adoption of the term is to be heartily commended. In the same number of the *Anthropologist* Dr. Ales Hrdlicka describes and figures "a new joint formation," apparently a unique case of the humerus sending out a new process to form a joint with the dislocated head of the radius. The bones are from an Amerindian burial place in Kentucky.

An anomalous skeleton is described by Hrdlicka in Vol. XII, pp. 81–107, of the *Bulletin of the American Museum of Natural History*. The skeleton was found in the vicinity of the city of Mexico. It has 13 pairs of ribs, and also presents the anomaly known as a "bicipital rib." The sternum is completely ossified — an exceptional condition among Amerindian skeletons, the author states — and its body is perforated by two large foramina. The long bones of the arm exhibit in an accentuated degree the proportions seen in the negro. The femora are platymeric, said to be a frequent type among Amerindians. The tibiæ are proportionally long and their heads are inclined backward. A list of titles of works relating to bicipital, supernumerary, and cervical ribs is given.

In a privately printed booklet of 30 pages W. H. Furness contributes a sketch of the "Folk-lore of Borneo." A charming account is given of the Kayan and Dayak origin myths; the native conception of the after-life; the magic power of names; the custom of head-hunting, etc. Five excellent illustrations of the natives and their surroundings are furnished.

PSYCHOLOGY.

Psychology of Paramecium. — The analysis of the reactions of Paramecium from a psychological standpoint has been undertaken by H. S. Jennings.[1] It is well known that Paramecia will swarm in great numbers around masses of food. It is also well known that they form large shoals after having been dispersed in a fluid, and that they avoid centers of alkaline reaction and frequent regions showing acid qualities. Such reactions as these have led many investigators to conclude that Paramecium has sensations, exerts choice, possesses social instincts, and, in fact, exhibits in an elementary way all the essential characteristics of an intelligent animal. Dr. Jennings's work has shown that Paramecia take up any foreign particles irrespective of their appropriateness as food, and, further, that these organisms will collect around a piece of inert filter paper with as much avidity as around a mass of real food. This is due to the fact that the normal forward motion of the infusorian is suspended the moment the animal comes in contact with a solid body, and the animal lies slowly rotating next the body with which it is in contact. Most solid bodies then become centers around which Paramecia accumulate. The social instinct of forming shoals is shown to be due to the influence of carbon dioxide. When for any reason two or three Paramecia stop together, the amount of carbon dioxide produced seems to be sufficient to ensnare and hold others, and thus the nucleus of a shoal is formed. The large assemblies of Paramecia are held together, not by social instinct, but by their own carbon dioxide. The so-called attraction for carbon dioxide and other acids is shown not to be an attraction. The organisms running at random pass eventually into an acid region, at the edges of which they always react in such a way as to remain within the acid area. In a similar way there is no repulsion from alkalis, but when met the animal reacts by turning aside. In this way the reactions of Paramecium are reduced to simple machine-like responses, which no more require the assumption of intelligence for their performance than does the contraction of an isolated muscle. G. H. P.

[1] Jennings, H. S. The Psychology of a Protozoan, *American Journal of Psychology*, vol. x, no. 4.

PHYSIOLOGY.

Ocular Changes Induced by Low Temperature. — Du Bois-Reymond long ago pointed out that when a frog is subjected for a considerable period to a freezing temperature the animal responds by contracting the pupils and closing the eyes. Dr. G. Abelsdorff (*Centralblatt für Physiologie*, Bd. XIII, p. 81) has observed a third ocular symptom, namely, a change in the color of the pupil from black to a gray or milk-white. This is due to the formation of a temporary cataract in the cortical part of the lens. On allowing a frog to recover from a semi-frozen condition, the animal regains its activity before the lens is clear and is for the time being blind; eventually the cataract disappears, and the frog is in all respects normal. The author suggests that cataracts of this kind may occur naturally in hibernating animals.

G. H. P.

Birch's Physiology. — A new class book of elementary practical physiology has been prepared by Professor De Burgh Birch.[1] The first hundred pages are devoted to an account of the construction and use of the microscope, ordinary histological methods, and mammalian histology. The account is necessarily meager and decidedly less satisfactory than that given in the ordinary histologies of the day. Thus in the matter of microtomes for paraffin work, a small hand microtome and the old-fashioned Cambridge rocking microtome are the only ones mentioned. The second part of the book, some sixty pages, deals with the chemistry of the body, including food, blood, bile, and urine. The third and concluding part, of about ninety pages, is devoted to experimental work on nerve and muscle, with a few directions for work on the circulation and some of the senses. The illustrations are sufficiently numerous, but poorly described, so that one is left to guess at what much of the lettering means. It is a question whether such books should not be called rudimentary rather than elementary.

G. H. P.

Formation of Fibrinogen. — The formation of fibrinogen in the blood of mammals has been investigated by Albert Mathews.[2] The fibrinogen in the blood of a cat may be removed by repeated bleed-

[1] Birch, De Burgh. *A Class Book of Elementary Practical Physiology*. Philadelphia, P. Blakiston's Son & Co. 1899. 273 pp.

[2] Mathews, A. The Origin of Fibrinogen, *The American Journal of Physiology*, vol. iii, pp. 53–85. September, 1899.

ings, defibrinations, and reinjections. The reformation of fibrinogen takes place normally in the absence of the spleen, the pancreas, the kidneys, the reproductive organs, and the brain; but only in very small amounts if the intestines be removed. Fibrinogen is not formed directly from the proteid constituents of the food, for it readily reforms after protracted fasting. If leucocytosis be prolonged for several days by suppurations, the fibrinogen of the blood increases. Fibrinogen is, therefore, probably produced by the decomposition of leucocytes, especially those of the intestinal area. As the fibrinogen of the blood brings about a contractile fibrillar structure in forming a clot, so possibly the fibrinogen of a cell such as a leucocyte may be connected with the formation of the contractile fibrils of the asters in cell division.

G. H. P.

ZOÖLOGY.

The Rotifera.[1] — In this, the first part of a proposed monographic treatment of the Rotifera, Lund gives the more general results of a study which has been conducted on a broad basis. The author has undertaken to examine the group from a purely objective standpoint, without regard to theories of the primitive nature of the organs of the animals, nor of the relationship of the Rotifera to other groups. The result is the most valuable contribution to the biology, morphology, and classification of the Rotifera that has appeared for many years.

Lund examines successively the principal structures that may be used in classification — the nature of the cuticula, the ciliary organ, the mouth parts, the foot, and the sense organs. A strictly objective comparative anatomical standpoint, unbiased by previous theories, is maintained in this study. The structures in question are traced in all their modifications and transitions throughout the group, and an attempt is made to discover the primitive condition of each, together with the path of evolution in the development of the more striking modifications. The œcological value of the organs is brought throughout into the closest relation with their structure. The result is a classification of the Rotifera differing widely from those based on preconceived ideas as to the relationship of this group to the Trochophora, or to other groups; a classification which

[1] *Denmarks Rotifera. I. Grundtraekkene i Rotiferernes Okologi, Morfologi og Systematik*, af C. Wesenberg Lund. Kjøbenhavn, 1899. 145 pp., 2 plates.

may, whatever its imperfections in detail, be truly called a natural one. In the successive examination of the structures above named, the fact is clearly brought out — a fact more or less patent to all who have worked extensively on the Rotifera — that all the widely separated members of the group are connected by transitional forms with the worm-like Notommatidæ. The latter form thus a central group, from which the others have diverged along different lines. Certain of the Notommatidæ present what must be looked upon as the primitive form of the structures in question — a soft cuticula ; ciliary organ, consisting of a flat disk on the ventral side, covered with undifferentiated cilia ; forcipate mouth parts, and two pairs of lateral sense organs. From this central group some six or seven lines of evolution in different directions are traced, each marked by successive changes from the primitive form of the organs above mentioned, in correspondence with the life habits of the animals.

These studies form the basis of the classification which follows. In this classification one or two points are worthy of especial mention. The division of the larger part of the Rotifera on the basis of the stiffness or softness of the cuticula into the two general groups, Loricata and Il-loricata, which has proved such a stumbling-block to a natural classification, is done away with. To the presence or absence of the foot little importance is attached. Whether one can or cannot agree in detail with the exact arrangement of the genera within the system as given, I believe it must be admitted that this is the nearest to a natural system of the group that has ever been given, and that it will be upon some such lines as these that the final classification of the Rotifera will be made.

The paper is one deserving of study by all students of the Rotifera. It is, moreover, a model for the way in which the general life relations of animals may be brought into correlation with their morphology and classification ; as such it has claims on the interest of others beside the specialist in Rotifera. Unfortunately, the work is rendered somewhat less easily accessible in that it is written in the Danish language instead of in one of the four languages that form the recognized necessary linguistic equipment of the man of science.

H. S. JENNINGS.

Segmentation of Insect Head. — The segmentation of the insect head, as seen in the Collembola, has been studied by J. W. Folsom.[1]

[1] Folsom, J. W. The Segmentation of the Insect Head, *Psyche*, vol. viii, pp. 391–394. August, 1899.

In addition to the somites represented by the compound eyes and the antennæ, many Collembola possess rudimentary intercalary appendages, indicating a third premandibular somite. The remaining somites are represented by the mandibles, the superlinguæ, the first maxillæ, and the labium. At an early stage these seven somites have each a pair of ganglia; the three pairs of premandibular ganglia unite to form the supracœsophageal ganglion, and the remaining four pairs fuse to form the subœsophageal ganglion. A comparison of the hexapod and crustacean head is shown as follows: —

SOMITE.	HEXAPODA.	CRUSTACEA.
1	Compound Eyes	Compound Eyes
2	Antennæ	Antennules
3	Intercalary Appendages	Antennæ
4	Mandibles	Mandibles
5	Superlinguæ	First Maxillæ
6	First Maxillæ	Second Maxillæ
7	Labium	First Maxillipedes

G. H. P.

The optic nerves of amphibians, according to the researches of Fritz,[1] undergo a total crossing in the chiasma, so that all the fibres from one eye pass to the other side of the brain. The chiasma has the form of interwoven bundles, which in the Urodela are larger in the middle of the nerves and smaller dorsally and ventrally, and in the Anura are larger ventrally and smaller dorsally. The chiasma has relatively few glia cells compared with the optic nerve. The courses of the nerve fibres in the chiasma were demonstrated by ordinary histological methods and degeneration experiments. Four weeks after the extirpation of an eye the optic nerve fibres began to show the first evidences of degeneration, a condition obtained in warm-blooded animals in two days. In seven months after the removal of the eye the severed nerve had entirely disappeared. The process of absorption which accompanies the degeneration of the nerves in Amphibia makes the degeneration method much less satisfactory for these animals than for other vertebrates. G. H. P.

Notes. — The few Ophidian tapeworms heretofore known have been supplemented by the discovery of a new species, *Ichthyotænia*

[1] Fritz, F. Ueber die Struktur des Chiasma nervorum opticorum bei Amphibien, *Jena. Zeitschr. für Naturwissenschaften*, Bd. xxxiii, pp. 191–262, Taf. VI–XI. 1899.

Calmettei Barrois, in *Bothrops lanceolatus* from Martinique. G. Marotel gives (*Arch. Parasitol.*, Vol. II, Part I, pp. 34–42, 4 text-figs.) a full account of its structure and demonstrates its affinity to the fish cestodes of the genus Ichthyotænia.

An interesting case of nursing habits among frogs is reported by Brauer (*Zool. Jahrb., Abt. Syst.*, Bd. XII, 1898, pp. 89–94) for *Arthroleptis seychellensis*. The eggs are deposited on the ground and brooded by the adult, probably the male; when the larvæ desert the shell, they possess posterior extremities, already indicated, and a long tail. They creep onto the back of the adult, fasten themselves, not by the mouth, but by the ventral surface, and undergo the remainder of their development there.

The little-known nematode genera Hystrichis and Tropidocerca, which occur in the crop of shore birds, have been restudied by von Linston (*Arch. f. Naturges.*, 1899, pp. 155–164, Pls. XIII, XIV). Many doubtful points in their structure are cleared up.

"Fresh-water Biological Stations: America's Example," by D. J. Scourfield (*Nat. Sci.*, June, 1899, pp. 450–454), reviews the progress in this line of work here and the apparent lack of interest in England. It is certainly true that in this matter at least "England has not done her duty."

The biological investigation of Lake Erie, under the auspices of the U. S. Fish Commission, has made good progress this year. The party, under the direction of Professor Reighard, was located at Put-in-Bay, O., during July. Among other things may be noted that Trochosphæra appeared again, and *Palæmonetes exilipes* was found in large numbers. During August one party made a reconnoissance along the lake shore, while another worked in the deeper water of the open lake.

The first part of the third volume of Kölliker's *Handbuch der Gewebelehre des Menschen* has just appeared under the editorship of Professor Victor von Ebner, and contains an account of the digestive, respiratory, and excretory organs, together with descriptions of such nearly related structures as the organs of taste, the thymus and thyroid glands, the suprarenal bodies, etc.

No. 5 of the second volume of the *Zoölogical Bulletin* contains the following contributions: "A Male Erpetocypris Barbatus Forbes," by C. H. Turner; "The Reduction Divisions in the Spermatogenesis of Desmognathus Fusca," by B. F. Kingsbury; "Ovarian Structure

in an Abnormal Pigeon," by M. F. Guyer; "Some Interesting Egg Monstrosities," by C. W. Hargitt; "A Redescription of Pariotichus Incisivus Cope," by E. C. Case; and "On the Pithecoid Type of Ear in Man," by H. Ayers.

Beginning with the third volume, the *American Journal of Physiology* will be issued in monthly instead of quarterly parts. In this change, however, an increase in the total annual output is not contemplated. The first number under the new arrangement contains the following articles: "The Relaxation of the Bladder Muscles of the Cat," by C. C. Stewart; "The Reaction of Amœba to Lights of Different Colors," by N. R. Harrington and E. Leaming; "Metabolism in the Submaxillary Gland during Rest and Activity," by Y. Henderson; "Studies in the Contraction of Smooth Muscle," by R. S. Woodworth; and "A Comparative Study of Reflex Action after Complete Section of the Spinal Cord in the Cervical or Upper Dorsal Region," by B. Moore and H. Oertel. The second number is made up as follows: "The Origin of Fibrinogen," by Albert Mathews; "A Contribution to the Comparative Physiology of Compensatory Motions," by E. P. Lyon; "The Functional Adaptability of Afferent Nerve Fibres," by S. P. Budgett and J. Green, Jr.; and "Comparison of the Effects of Certain Inorganic Solutions and Solutions Containing Serum Albumin on the Rhythmic Contractility of the Frog's Heart," by E. C. Walden.

The second part of Vol. XV of the *Journal of Morphology* contains the following articles: "The Ovarian Egg of Limulus, a Contribution to the Problem of the Centrosome and Yolk Nucleus," by J. P. Munson; "The Lateral Line System of Batrachus Tau," by C. M. Clapp; and "Comparative Cytological Studies, with Especial Regard to the Morphology of the Nucleolus," by T. H. Montgomery, Jr. It is to be regretted that while this number is dated November, 1898, it should not have been issued till August, 1899.

NEWS.

By the death of Sir William Henry Flower, which occurred July 2, England loses one of her best vertebrate zoölogists. He was born in 1831, was educated as a surgeon, but since the early sixties his work was largely in zoölogical lines. In 1884 he was placed in charge of the Natural History division of the British Museum, a post which he held until last year. He was best known to students from his text-book on the osteology of the Mammalia and the work on the Mammalia produced in collaboration with Dr. Lyddeker.

Mr. Emerson McMillin, of New York, has given $1000 to the research fund of the American Association for the Advancement of Science.

The collection of birds, chiefly European, made by Henry E. Dresser, and which served as the basis of his "Birds of Europe," has been acquired by the Manchester Museum. It contains about 10,000 specimens.

Drs. Dohrn of Naples, Fischer of Berlin, and Treub of Buitenzorg were recently elected foreign members of the Royal Society.

Professor Henry G. Jesup, who has held the chair of botany in Dartmouth College for twenty-two years, has resigned.

Professor V. M. Spaulding will resume his work in botany in the University of Michigan this fall.

Science has a correspondent of sensitive temperament, whose ear is offended by the term "pot hole"; he would suggest the term "remolino" in its place.

An Entomological Society has been founded in Albany, N. Y. Dr. E. P. Felt, the state entomologist, has been elected president.

The sons of the late Professor Jules Marcou have presented his geological library, consisting of 3,000 volumes, 10,000 pamphlets, and 1,200 maps, to the American Museum of Natural History in New York.

Dr. Adolf Fick, professor of physiology in the University of Würzburg, has resigned at the age of 70.

The next lectures on the George William Huntington foundation at the Johns Hopkins University will be given by Professor W. C. Brögger, of the University of Christiania, in April, 1900. He will take for his subject modern deductions regarding the origin of igneous rocks.

Over fifty students attended the Coldspring Harbor Biological Laboratory during the summer just past.

An egg of the great auk, slightly cracked, was recently sold in London for 300 guineas.

Recent appointments: M. Ardaillon, professor of geography at Lille. — Carlton R. Ball, assistant in the division of agrostology of the United States Department of Agriculture. — Elmer D. Ball, assistant entomologist in the Colorado Experiment Station at Denver. — Dr. Dante Bertelli, of Pisa, associate professor of anatomy in the University of Padua. — Ernst A. Bessey, assistant in the division of vegetable physiology and pathology of the Department of Agriculture. — H. Blodgett, assistant botanist and entomologist at the Experiment Station at Jamaica, N. Y. — Dr. J. Warwick Brown, examiner in zoölogy in the University of Aberdeen. — Dr. O. W. Caldwell, professor of botany in the State Normal School at Charleston, Ill. — Dr. E. Wace Carlier, professor of physiology in Mason College, Birmingham, England. — M. Chatin, professor of anatomy at Bordeaux. — Judson F. Clark, assistant in botany in Cornell University. — J. F. Collins, instructor in botany in Brown University. — Dr. G. Davis, assistant professor of applied anatomy in the University of Pennsylvania. — Dr. M. von Frey, professor of physiology in the University of Würzburg. — M. Guitel, adjunct professor of zoölogy at Rennes. — Heinrich Hasselbring, assistant in botany in Cornell University. — George J. Hastings, assistant in botany in Cornell University. — Dr. P. C. Bruno Henneberg, docent for anatomy in the University of Giessen. — Dr. A. J. Herbertson, lecturer on physical geography in the University of Oxford. — Dr. W. H. Hobbs, professor of mineralogy and petrology in the University of Wisconsin. — Dr. A. C. Houston, lecturer in bacteriology in Bedford College, London. — Dr. Ida Hyde, assistant professor of zoölogy in the University of Kansas. — Dr. A. Jakowatz, demonstrator in the botanical museum of the University of Vienna. — Dr. Hermann E. Johanssen, assistant in the zoölogical museum of the University at Tomsk, Siberia. — Dr. K. Keissler, assistant in the botanical museum of the University of Vienna. — P. Beveridge Kennedy, assistant in

the division of agrostology, United States Department of Agriculture. — Dr. Benjamin F. Kingsbury, assistant professor of microscopy and embryology in Cornell University. — Dr. Alfred Kohn, docent in histology in the German University of Prague. — Dr. Henry B. Kümmel, of Chicago, assistant state geologist of New Jersey. — M. Künstler, professor of comparative anatomy and embryology at Bordeaux. — Miss A. Lambert, assistant lecturer in biology in the University of Melbourne. — Professor Malcolm Laurie, examiner in zoölogy in the University at Glasgow. — Dr. R. S. Macdougall, lecturer on botany in the Heriot-Watt College, Edinburgh. — Curtis F. Marbut, professor of geology in the University of Missouri. — Dr. Rudolf Martin, professor extraordinarius of anthropology in the University of Zürich. — Elmer D. Merrell, assistant in the division of agrostology, United States Department of Agriculture. — Dr. W. D. Merrell, instructor in botany in the University of Rochester. — Mr. E. A. Minchin, of Oxford, Jodrell professor of zoölogy in University College, London. — Mr. Geo. T. Moore, instructor in botany in Dartmouth College. — W. A. Orton, assistant in the division of vegetable physiology and pathology, United States Department of Agriculture, to study diseases of cotton. — C. S. Prosser, associate professor of historical geology at the University of Ohio. — Dr. August L. Rimbach, instructor in vegetable physiology and pathology in the University of Nebraska. — Herbert F. Roberts, assistant in the Shaw School of Botany, St. Louis. — P. H. Rolfs, professor of botany in Clemson College, S. C. — Dr. E. A. Schaefer, of London, professor of physiology in the University of Edinburgh. — Dr. Friedrich Schenck, professor extraordinarius of physiology in the University of Würzburg. — Hermann von Schrenk, special agent in the division of vegetable pathology of the United States Department of Agriculture, to study the diseases of forest trees. — M. V. Slingerland, assistant professor of entomology in Cornell University. — Dr. Wilson R. Smith, instructor in botany in McMaster University, Toronto. — Dr. Sommer, docent for physiology in the University of Würzburg. — Dr. E. H. Starling, Jodrell professor of physiology in the University of London. — G. A. Stonier, specialist in mining on the Geological Survey of India. — Dr. Strickelson, privat docent for geography in the University of Basel. — Professor Ph. van Tieghem, professor of the biology of cultivated plants in the National Agrionomic Institute at Paris. — H. G. Timberlake, instructor in botany in the University of Wisconsin. — Dr. M. Treub, director of the botanical gardens at Buitenzorg, Java. — Miss H. V. Whitten, tutor in geology in the

University of Texas. — Dr. K. M. Wiegand, instructor in botany in Cornell University. — D. L. Wilder, of Des Moines, Iowa, assistant on the Iowa Geological Survey. — Dr. Gregg Wilson, lecturer on biology in the Royal Veterinary College at Edinburgh, and lecturer on zoölogy at the Heriot-Watt College.

Deaths: Professor Balbiani, the well-known embryologist of the Collége de France, aged 75. — Dr. Ernst Beinling, assistant in the Botanical Experiment Station in Karlsruhe, in May. — Professor H. R. Geiger, sometime assistant on the United States Geological Survey, at Springfield, Ohio, July 18. — Mr. N. R. Harrington, instructor in zoölogy in Western Reserve University, in Atabara, Egypt, of typhoid fever, July 27. — Stefan Ph. Jakshich, professor of botany in the University of Belgrade, May 15. — The French geologist, Adolphe Legeal, has been murdered in the Sudan. — Christian Lippert, cryptogamic botanist, in Vienna, May 21. — Alphonse de Marbaix, professor of zoölogy in the Agricultural Institute at Louvain. — Dr. Joseph Mies, anatomist and anthropologist, in Cologne, June 9, aged 39. — W. W. Norman, professor of biology in the University of Texas, in Boston, about the first of July. — Dr. Gustaf Pernhoffer, botanist, in Vienna, May 17. — Wilhelm Rudel, student of Coleoptera and Lepidoptera, in Breslau, April 30, aged 81. — Rev. Jonathan Short, of Hoghton, England, a geologist and antiquarian, May 17, aged 73. — Henry Thomas Soppitt, mycologist, in Halifax, April 1, aged 40. — John Whitehead, collector and explorer, in the island of Hainan, aged 43.

CORRESPONDENCE.

To the Editor American Naturalist:

SIR, — In your May issue, p. 437, you publish a note by D. S. J. referring to the recent *Report of the Thetis Trawling Expedition on the Coast of New South Wales.* Your contributor writes: "The nomenclature is very antiquated, the author apparently depending almost entirely on *Günther's Catalogue of the Fishes of the British Museum,* the one published volume of Boulenger's masterly catalogue being ignored."

In common justice the writer might have taken note of the following passage on page 27 of the publication: "The present report is of a popular character, and has been prepared rather for the benefit of the commercial than the scientific community. To this end the technical names employed are not necessarily those of strict science, but are those by which the various fishes are best known to amateurs both in science and fishing." The nomenclature is mainly that of the catalogue of the fishes of New South Wales, by J. Douglas-Ogilby, a work largely used by those for whom the report was written.

That I did not ignore Boulenger's catalogue should be apparent from the occurrence in the report of the names *Cæsioperca lepidoptera*, *Epinephelus septemfasciatus*, and *Acanthistius serratus.*

I am, sir, yours faithfully,

EDGAR R. WAITE.

AUSTRALIAN MUSEUM, SYDNEY, June 16, 1899.

PUBLICATIONS RECEIVED.

(The regular Exchanges of the *American Naturalist* are not included.)

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(*No. 393 was mailed September 23.*)